

# Materialsammlung

ZUR

## FGF-Themenanalyse

„Sind Mobilfunk und andere Funkanwendungen ein besonderes Risiko für Kinder? -  
Wissenschaftliche Fakten über ein komplexes Thema“

### Inhalt

- Tabellarische Übersichten
- Abstracts der relevanten Reviews
- Extrakte aus Reports und Statements nationaler und internationaler Kommissionen und Institutionen
- Länderübergreifende Forschungsprogramme und nationale Studien
- Sammlung von Medienveröffentlichungen zum Thema
- Referenzliste

### Gesamtübersicht

Art der Studie	Anzahl der Studien insgesamt	Anzahl Studien ohne Effekt	Anzahl Studien mit Effekt	Anzahl Studien mit un schlüssigem Effekt
Tierstudie	114 4 davon „keine Daten verfügbar“	42	53	14
Laboruntersuchung an Jugendlichen und Kindern	9	3	5	1
Epidemiologische Studie	23	5	11	7
Dosimetrische Messung/Berechnung	72	–	–	–
Review	41	–	–	–

### Tierstudien

Thema	Anzahl	Zeitraum	Objekt	Frequenz	Ergebnis
Entwicklung	29	1975 - 2009	Ratten (11)	2.45 GHz (15)	+(7), -(6), ±(1), ?(1)
			Mäuse (10)	54 – 78 GHz (1)	+(1)
			Wachteln (3)	10 GHz (1)	+(1)
			Andere (5)	9.8 GHz (1)	±(1)
				6 GHz (2)	+(2)
				915 MHz (4)	+(2), -(1), ?(1)
				460 MHz (2)	+(1), ±(1)
				27 MHz (1)	?(1)
				10 MHz (2)	+(2)
				UMTS (1)	-(1)
			Teratologie	28	1975 - 2000 2009 (2)
Mäuse (10)	6 GHz (2)	-(2)			
Andere (3)	1.95 GHz (1)	-(1)			

				915 MHz (3) 428 MHz (1) 10 MHz (5) k.A. (1) UWB (1)	-(3) +(1) +(3), -(1), ?(1) +(1) ?(1)
Fortpflanzung	29	1975 - 2009	Ratten (14) Mäuse (7) Wachteln (3) Andere (5)	2.45 GHz (15) 10 GHz (1) 1.9 GHz (2) 1.62 GHz (1) 915 MHz (5) 836 MHz (2) 260 MHz (1) 10 MHz (1) UWB (1)	+(3), -(11), ?(1) +(1) +(1), -(1) -(1) +(2), -(1), ?(2) -(1), ?(1) +(1) ?(1) -(1)
Immunsystem	14	1981- 2006	Ratten (8) Wachteln (4) Mäuse (2)	2.45 GHz (7) 6 GHz (2) 37 -60 GHz (1) 836 MHz (1) 890 -915 MHz (2) 425 MHz (1)	+(3), -(2), ±(2) +(1), -(1) +(1) ?(1) -(2) +(1)
Temperatur	16	1983 - 2008	Ratten (9) Mäuse (2) Hühner (2) Andere (3)	2.45 GHz (8) 35 -94 GHz (1) 6 GHz (2) 1.25 GHz (1) 10 MHz (3) 460 MHz (1)	+(4), -(1), ?(3) +(1) -(1), ?(1) +(1) +(2), ?(1) +/- (1)
ZNS	13	1981 - 2009	Ratten (8) Mäuse (4) Andere (1)	2.45 GHz (9) 900 MHz (3) 870 MHz (1)	+(5), -(3), ?(1) +(2), -(1) -(1)
Kognitive Funktionen/Verhalten	10	1982 - 2009	Ratten (8) Mäuse (2)	2.45 GHz (3)  37 – 60 GHz (1) 6 GHz (1) 900–915 MHz (3) 860-870 MHz (2)	+(2), +/- (1) +(1) +(1) -(3) +/- (1), ?(1)
Physiologische Funktionen	9	1975 - 2009	Ratten (5) Andere (4)	2.45 GHz (4) 7.5 GHz (1) 6 GHz (1) 1.8 GHz (1) 915 MHz (2)	-(4) +(1) -(1) +(1) -(2)
Krebs	6	1994 - 2007	Ratten (5) Mäuse (1)	2.45 GHz (1) 1.95 GHz (1) 1.62 GHz (1) 860 MHz (1) 836 MHz (2)	-(1) -(1) -(1) -(1) -(2)
Kardiologische Funktionen	6	1980 - 1998	Ratten (2) Hühnerembr. (2) Andere (2)	2.45 GHz (4) 35 GHz (1) 500 kHz (1)	+(3), -(1) +(1) +(1)
Genotoxizität	5	1988 - 2007	Ratten (4) Mäuse (1)	9.4 GHz (1) 1.6 GHz (1)	+(1) -(1)

				900 MHz (2) 834 MHz (1)	-(2) +(1)
Bluthirnschranke	7	2003 - 2009	Ratten (5) Mäuse (2)	1.4 GHz (1) 900 MHz (3) 915 MHz (3)	-(1) -(3) +(1) -(2)
Endokrinologie	6	1988 - 2008	Ratten (5) Wachteln (1)	2.45 GHz (4) 1.95 GHz (1) 915 MHz (1)	+ (4) ?(1) -(1)
Enzymaktivitäten	5	1980 – 1996 2006	Mäuse (2) Wachteln (2) Ratten (1)	2.45 GHz (5)	+(3), -(2)
Hitzeschockproteine	4	2001 – 2009	Ratten (1) Mäuse (1) Andere (2)	2.06 GHz (1) 1.9 GHz (1) 915 MHz (1) 900 MHz (1)	±(1) +(1) +(1) -(1)
Metabolismus	2	1991 2006	Ratten (1) Wachteln (1)	2.45 GHz (1) 834 MHz (1)	-(1) -(1)
Knochenheilung	1	1993	Ratten (1)	EMF (1)	+ (1)
Auge	1	2002	Affen (1)	35 und 94 GHz	+ (1)

„-“ kein Effekt, „+“ Effekt, „±“ unschlüssiges Ergebnis  
Mehrfachnennungen pro Studie möglich

## Laboruntersuchungen an Jugendlichen und Kindern

Erstautor	Jahr	Frequenz	Expositionstärke	Untersuchungsparameter	Ergebnis
Kramarenko (Ukraine)	2003	900 MHz	Keine Angaben	EEG	+
Krause (Finnland)	2006	900 MHz	im Bereich und über internationalen Grenzwerten	EEG	+
Lee (China)	2001	Mobiltelefon	Keine Angaben	Kognitive Funktionen	+
Haarala (Finnland)	2005	902 MHz	im Bereich internationaler Grenzwerte	Kognitive Funktionen	-
Preece (UK)	2005	902 MHz	im Bereich internationaler Grenzwerte	Kognitive Funktionen	-
Abramson (Australien)	2009	Mobiltelefon	Keine Angaben	Kognitive Funktionen	+
Capri (Italien)	2006	1.8 GHz	im Bereich internationaler Grenzwerte	Immunsystem	±
Clark (USA)	2007	Radio- und Fernseh-Sender 0.1 - 3000 MHz	Unterhalb internationaler Grenzwerte	Hormonstatus	-

Rezk (Ägypten)	2008	900 MHz	Keine Angaben	Herztätigkeit	+
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„-“ kein Effekt, „+“ Effekt, „±“ unschlüssiges Ergebnis

## Epidemiologische Studien

Erstautor	Jahr	Frequenz	Untersuchungsparameter	Ergebnis
Ouellet-Hellstrom (USA)	1993	Diathermiegerät Kurz- und Mikrowellen	Fehlgeburtsrate	+
Liu (China)	2007	Mobiltelefon und Mikrowellenofen	Fehlgeburtsrate	±
Guberan (Schweiz)	1994	Diathermiegerät Kurz- und Mikrowellen	Geschlechterverhältnis der Nachkommen	-
Baste (Norwegen)	2008	Radar	Geschlechterverhältnis der Nachkommen	+
Maskariniec (Honolulu)	1994	Radiosender	Leukämie	+
Hocking (Australien)	1996	Radio- und Fernsehsender	Leukämie und Hirntumor	Leukämie + Hirntumor -
Dolk (UK)	1997	Radio- und Fernsehsender	Leukämie und Hirntumor	Leukämie - Hirntumor -
McKenzie (Australien)	1998	Fernsehantennen	Leukämie	-
Michelozzi (Italien)	2002	Radiosender	Leukämie	+
Hocking (Australien)	2003	Fernsehsender	Leukämie	+
Park (Korea)	2004	Radio- und Fernsehsender	Leukämie	+
Ha (Korea)	2007	Mittelwellen- Rundfunksender	Leukämie und Hirntumor	Leukämie ± Hirntumor -
Merzenich (Dänemark)	2008	Fernsehsender (VHF/UHF), UKW/FM Radiosender, Mittelwellen- Rundfunksender	Leukämie	-
Hardell (Schweden)	2004	analoges Mobiltelefon, digitales Mobiltelefon, GSM, NMT, Schnurlostelefon	Hirntumor	+ (erhöhtes Risiko bei jungen Erwachsenen im Vergleich zu älteren Erwachsenen)
Chia (Singapore)	2000	Mobiltelefon	Kopfschmerzen	+
Preece (UK)	2007	Militärantennensystem (7 – 30 MHz)	Krebs allgemein, Geburtsfehler, Probleme bei der Entbindung, Kopfschmerzen, Migräne	-
Soderqvist (Schweden)	2008	DECT-Telefon	Kopfschmerzen, asthmatische Symptome, Konzentrationsschwierigkeiten	±

Kolodynski (Lettland)	1996	Radar (154 -162 MHz)	Kognitive Funktionen	+
Kane (USA)	2004	„HF-Strahlung“	Verhaltensprobleme (ASD, Autismus)	±
Divan (Dänemark)	2008	Mobiltelefonfrequenzen	Verhaltensprobleme (Hyperaktivität)	±
Lerman (Israel)	2001	Diathermiegerät	Missbildungen	+
Mjoen (Norwegen)	2006	HF-Strahlung	Missbildungen	±
Preece (UK)	2007	Militärantennensystem 7 -30 MHz	Missbildungen	-

„-“ kein Effekt, „+“ Effekt, „±“ unschlüssiges Ergebnis

## Arbeitsgruppen

Arbeitsgruppe	Herkunft	Publikationen	Zeitraum	Frequenz	Grenzwertnähe	Methoden
Carter/Berman	USA	7	1978 - 1992	2,45 GHz (6) 970 MHz (1)	+	Tierstudien (7) - +++ ±± \
Dimbylow	UK	11	1993 - 2009	-	./.	Dosimetrie (11)
Finnie	Australien	4	2006-2009	900 MHz (4)	+	Tierstudien (4) ----
Gabriel	UK	3	2001 - 2009	-	./.	Dosimetrie (3)
Gandhi	USA	5	1991 2002	-	./.	Dosimetrie (5)
Hardell	Schweden	4	2004 - 2008	Mobilfunk DECT (1)	./.	Review (2) Epidemiol. (2) + ±
Jensh	USA	7	1982 – 1984, 1997	915 MHz, CW (2) 2,45 GHz, CW (2) 6 GHz (2)	+	Tierstudien (6) ---- ++ Review (1)
Kheifets	USA (California)	8	2003 - 2008	Mobilfunk (1)	./.	Review (7) Epidemiol. (1) ±
Kuster	Schweiz	8	1998 - 2009	-	./.	Dosimetrie (8)
Leitgeb	Österreich	3	2007 - 2008	-	./.	Dosimetrie (2) Risikokomm. (1)
McRee Hamrick	USA (North Carolina)	20	1975 - 1988	2,45 GHz, CW (20)	++/-	Tierstudien (20) ----- ++++++ ±±±± \ \
Merrit	USA	3	1984	2,45 GHz (2)	+/-	Tierstudien (2)

			2003			-- Review (1)
Nakamura/Ogino	Japan (Kanazawa)	3	1997 – 2003	2,45 GHz (2) 915 MHz (1)	++/-	Tierstudien (3) ++ -
Nelson	USA	6	1991 - 2001	10 MHz (6)	+	Tierstudien (6) +++-±± (synerg. Effekte)
Radon	Deutschland	4	2006 - 2009	–	./.	Dosimetrie (3) m. sozialwissenschaftl. Hintergrund (1)
Schüz	Dänemark	5	2005 - 2009	Fernseh-, Radiosender	./.	Review (3) Epidemiol. (1) - Dosimetrie (1)
Watanabe	Japan (Nagoya)	15	2003 - 2009	1,95 GHz (2) 1,5 GHz (1) 1,439 GHz (1)	+/-	Dosimetrie (11) Tierstudien (4) ----
Andere		63	1973 – 2009	2,45 GHz (16) Mobilfunk (24) 1.25-1.6 MHz (3) Über 2,45 GHz (8) Unter GSM- Frequenzen (8) 2.06 GHz (1) UWB (1) UMTS (1) k.A. (1)	++/-	Tierstudien +++++++-----±? +++++++-----±?  +--  +++++++ ±  +++++++ ± ? ± + ±  +
		9	2003 – 2009	Mobilfunk (7) 1.8 GHz (2) 0.1-3000 MHz (1)	+/-	Laboruntersuchungen an Kindern und Jugendlichen +++++-- - ± -
		19	1993 – 2008	TV und Radiosender (10) shortwave/micr owave (3) DECT-Telefon Radar (2) RF (3) 7-30 MHz (1) hand held Telefone (1)	./.	Epidemiologie  +++++ --- ±±  ++ -  ++ ±±± -  +
		28	1984 – 2009	–	./.	Dosimetrie
		27	1985 - 2009	–	./.	Reviews

		3	2005-2007	-	./.	Studien mit sozialwissenschaftl. Hintergrund
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„-“ kein Effekt, „+“ Effekt, „±“ unschlüssiges Ergebnis, „?“ keine Angaben

+ = über dem Grenzwert, - = unter dem Grenzwert, +/- = im Bereich des Grenzwertes, ++/- bzw. +/- = im Bereich des Grenzwertes und entweder öfter über oder öfter unter dem Grenzwert

## Frequenzen (Tierstudien)

Frequenz	Häufigkeit	Effekt			Anwendung
54 -78 GHz	1	+			Radar
35 -94 GHz	2	++			
37 -60 GHz	1	+			
10 GHz	1	+			
9.8 GHz	1			+/-	Ultrabreitband
9.4 GHz	1	+			
7.5 GHz	1	+			
6 GHz	2	++			
2.45 GHz	46	+++++	-----	+/- +/-	Mikrowellenofen
		+++++	-----	+/- +/-	
		+++++	(18)	+/- +/-	
		+++++		+/- (7)	
2.06 GHz	1			+/-	
1.9 GHz	3	+	--		Mobilfunk Japan, UMTS, DECT
1.8 GHz	1	+			Mobilfunk E-Netz
1.6 GHz	2		--		Satellitenkommunikationssysteme
1.5 GHz	1		-		
1.4 GHz	1		-		Radioastronomie
1.25 GHz	1	+			Flugsicherungsradar
890-915 MHz	21	+++++	-----		Mobilfunk Europa
		+++	----		
			(13)		
860 - 870MHz	3		--	+/-	RFID, schnurlose Audioanwendungen, Funkalarmsysteme, TETRA uplink, Garagentorsender, Kurzstreckenfunkgeräte
834-836 MHz	3	+	--		Mobilfunk USA
460 MHz	3	+		+/-	? TETRA, Datennetze, Hilfsdienste, Taxi, etc.
425 -428 MHz	2	++			?
260 MHz	1	+			?
150 MHz	1		-		
27 MHz	1				? funkgesteuertes Spielzeug, CB-Funk, Motorrad-Fahrschulen,

						Garagentorsender, Kurzstreckenfunkgeräte, Diathermiegeräte
10 MHz	6	+++	-	+/- +/-		Amateurfunk, Funkwetterdienst, Militär
500 kHz	1	+				?
„EMF“	1	+				./.
UWB	1	+				./.

## Abstracts der relevanten Reviews

### **Epidemiological studies of human exposures to radiofrequency radiation. A critical review.**

Roberts Jr NJ, Michaelson SM: Int Arch Occup Environ Health 1985; 56 (3): 169 - 178

The health effects to exposure to radiofrequency radiation (RFR) remain undefined and controversial. Epidemiological studies of human exposures to RFR are confounded by difficulties in determining the type and true extent of exposures, in selecting an appropriate control group for comparisons, in determining the existence and influence of many concomitant environmental factors, and in establishing the presence or measuring the frequency or severity of subjective complaints as well as objective findings in the studied populations. This paper reviews reported RFR effects on general health, growth and development, physiological systems such as the cardiovascular and nervous systems, and organs such as the eye. Criteria for reliable epidemiological studies are presented to allow critical analysis of such reports.

### **The effect of embryonic and fetal exposure to x-ray, microwaves, and ultrasound: counseling the pregnant and nonpregnant patient about these risks.**

Brent RL: Semin Oncol 1989; 16 (5): 347 - 368

The term radiation evokes emotional responses both from lay persons and from professionals. Many spokespersons are unfamiliar with radiation biology or the quantitative nature of the risks. Frequently, microwave, ultrasound, and ionizing radiation risks are confused. Although it is impossible to prove no risk for any environmental hazard, it appears that exposure to microwave radiation below the maximal permissible levels present no measurable risk to the embryo. Ultrasound exposure from diagnostic ultrasonographic-imaging equipment also is quite innocuous. It is true that continued surveillance and research into potential risks of these low-level exposures should continue; however, at present ultrasound not only improves obstetric care, but also reduces the necessity of diagnostic x-ray procedures. In the field of ionizing radiation, we have a better comprehension of the biologic effects and the quantitative maximum risks than for any other environmental hazard. Although the animal and human data support the conclusion that no increases in the incidence of gross congenital malformations, IUGR, or abortion will occur with exposures less than 5 rad, that does not mean that there are definitely no risks to the embryo exposed to lower doses of radiation. Whether there exists a linear or exponential dose-response relationship or a threshold exposure for genetic, carcinogenic, cell-depleting, and life-shortening effects has not been determined. In establishing maximum permissible levels for the embryo at low exposures, refer to Tables 4, 5, 6, 8, and 9. It is obvious that the risks of 1-rad (.10Gy) or 5-rad (.05Gy) acute exposure are far below the spontaneous risks of the developing embryo because 15% of human embryos abort, 2.7% to 3.0% of human embryos have major malformations, 4% have intrauterine growth retardation, and 8% to 10% have early- or late-stage onset genetic disease. The maximal risk attributed to a 1-rad exposure, approximately 0.003%, is thousands of times smaller than the spontaneous risks of malformations, abortion, or genetic disease. Thus, the present maximal permissible occupational exposures of 0.5 rem for pregnant women (see Table 10) and 5 rem for medical exposure, are extremely conservative. Medically indicated diagnostic roentgenograms are appropriate for pregnant women, and there is no medical justification for terminating a pregnancy in women exposed to 5 rad or less because of a radiation exposure.

### **Epidemiologic studies of VDT use and pregnancy outcome.**

Marcus M: Reprod Toxicol 1990; 4 (1): 51 - 56

Exposition: magnetisches Feld, 50/60 Hz (Wechselstrom), PC/TV-Bildschirm, berufliche Exposition

Endpunkte: Effekte auf den Embryo/Fötus: Fehlbildung, Effekte auf die Fortpflanzungsfähigkeit: Schwangerschafts-Verlauf, Fehlgeburt  
Epidemiologie: Expositions-Abschätzung, Bias, Confounder  
KEINE WEITEREN DATEN VORHANDEN

#### **Risk factors for childhood brain tumors.**

Kuijten RR, Bunin GR: Cancer Epidemiol Biomarkers Prev 1993; 2 (3): 277 – 288  
KEINE WEITEREN DATEN VORHANDEN

#### **Bioeffects of electromagnetic fields--safety limits of each frequency band, especially less than radio one.**

Nakagawa M: Sangyo Eiseigaku Zasshi 1996; 38 (1): 1 - 10  
Since Wertheimer and Leeper reported in 1979 that children living near power distribution lines have as high as twice or three times the incidence of cancer, the relation of leukemia or cancer to extremely-low-frequency (ELF) electromagnetic field (EMF) has been a subject of repeated argument. We cannot sum up the bioeffects of EMF in a few words, for these are attributed to frequency difference. This review discusses the bioeffects of EMF ranging from frequency of microwave to static magnetic field with main stress on the so-called non-thermal effects below radiofrequency band. Non-thermal effects are rather weak compared with those of high frequency band and have been treated as unknown matter for a long period. However, as the EMF energy has come to be increasingly used at high levels, we can now clearly detect the bioeffects of induced eddy currents. On the other hand, some findings about low level ELF electromagnetic field suspected as a cancer-promoting factor are mainly gained by epidemiological method. Cancer researchers concerned with recent powerline issues are coming up with many reports on oncological effects of very low-level (0.1 microT order) ELF electromagnetic fields. More data, however, should be collected to reach appropriate conclusion about the possibility of low level ELF electromagnetic fields have an effect of cancer promotion. As for the safety standards of static magnetic field it should be noted that in 1993 National Radiation Protection Board (UK) and International Radiation Protection Association published the highest values ever recommended. These announcements would agree with our assumption that biological processes require high flux density of ELF-EMF proportional to  $1/f$ , where frequency and flux density are indicated with a logarithmic function.

#### **Epidemiological studies of radio-frequency radiation: current status and areas of concern.**

Goldsmith JR: Sci Total Environ 1996; 180 (1): 3 - 8

Exposition

hochfrequentes Feld, Mikrowellen, Radar, berufliche Exposition, häusliche Exposition

Endpunkte

Krebs: Entstehung von Krebs und Mutationen, Krebs bei Arbeitern und Kindern

Effekte auf die Fortpflanzungsfähigkeit: Schwangerschafts-Verläufe

Effekte auf das Herz-Kreislauf-System: hämatologische Wirkungen

Epidemiologie: Unsicherheiten wie biologischer Mechanismus, schwache experimentelle Evidenz,

Probleme bei der Durchführung epidemiologische Studien

Leitlinien/Sicherheit: Berücksichtigung der Evidenz in Richtlinien

KEINE WEITEREN DATEN VORHANDEN

#### **Radiofrequency field exposure and cancer: what do the laboratory studies suggest?**

Repacholi MH: Environ Health Perspect 1997; 105 : 1565 - 1568

Significant concern has been raised about possible health effects from exposure to radiofrequency (RF) electromagnetic fields, especially after the rapid introduction of mobile telecommunications systems. Parents are especially concerned with the possibility that children might develop cancer after exposure to the RF emissions from mobile telephone base stations erected in or near schools. These questions have followed scientific reports suggesting that residence near high voltage power lines may be associated with an increased childhood leukemia risk. Epidemiologic studies have been plagued by poor RF exposure assessment and differences in methodology. There are no high-quality epidemiologic studies that can be used to evaluate health risks from RF exposure. Laboratory studies in this area have been somewhat confusing. Some animal studies suggest that RF fields accelerate the development of sarcoma colonies in the lung, mammary tumors, skin tumors, hepatomas, and sarcomas. A substantial RF-induced increase in lymphoma incidence in transgenic mice exposed for up to 18 months has also been reported. In contrast, other studies have not found carcinogenic effects.

These conflicting results indicate the need for more well-conducted studies on laboratory animals, supplemented with high-quality in vitro studies to identify effects that need further research in vivo, and to characterize any acting mechanisms, especially at low RF field levels. This paper provides a review of the laboratory studies and indicates what conclusions about RF-induced cancer can be drawn.

### **Intrauterine effects of electromagnetic fields--(low frequency, mid-frequency RF, and microwave): review of epidemiologic studies.**

Robert E: *Teratology* 1999; 59 (4): 292 - 298

Electromagnetic radiations are named according to frequency or to wavelength (which is inversely proportional to frequency) and create electromagnetic fields (EMFs). Frequencies widely vary according to sources: high-voltage power lines, electrically heated beds, MRI, VDTs, microwave ovens, satellite, and radio/TV transmissions or cellular phone transmitters/receivers. Public concern has increased about the potential health effects of EMFs. There are arguments in favour of EMFs being biologically active, but no mechanism has been identified that explains the link between EMFs and bioeffects. Human data reviewed concern the potential reproductive effects (mainly spontaneous abortions, low birthweight and congenital malformations) of exposure to sources of EMFs: maternal residence, electrically heated beds, occupational exposure (mainly video display terminals), and medical exposures. The available epidemiologic studies all have limitations that prevent to draw clearcut conclusions on the effects of EMFs on human reproduction. EMFs are ubiquitous and unavoidable exposures. The matter of possible effects cannot be considered closed, but until our understanding of the biologic important parameters of EMFs exposures is stronger, design of new studies will be difficult and small epidemiologic studies are unlikely to provide definitive answers and should not be given high priority. No conclusion can be drawn for radiofrequencies and microwaves because of lack of data. There is no convincing evidence today that EMFs of the sort pregnant women or potential fathers meet in occupational or daily life exposures does any harm to the human reproductive process.

### **Recent data from the literature on the biological and pathologic effects of electromagnetic radiation, radio waves and stray currents.**

Orbach-Arbouys S, Abgrall S, Bravo-Cuellar A: *Pathol Biol (Paris)* 1999; 47 (10): 1085 - 1093

Electromagnetic radiation is present in increasing amounts in our environment, and its potential effects on human (and animal) health has been investigated. It remains unclear whether the risk of acute childhood leukemia is associated with cumulative exposure to magnetic fields. An association with brain cancer and colon cancer has been suggested in electrical company workers. The radars used by police departments may increase the incidence of cancer. Electromagnetic radiation may play a role in a number of disorders such as depression and memory loss. It has been established that cell phones interfere with pacemakers only if direct contact occurs and have no effect if held in their normal position. Interferences have been reported between pacemakers and shop-lifting detectors.

### **Intrauterine effects in animals exposed to radiofrequency and microwave fields.**

O'Connor ME: *Teratology* 1999; 59 (4): 287 - 291

The animal studies dealing with intrauterine exposure to radiofrequency (RF) fields have used only a few RF frequencies. More of the studies have used acute high exposures rather than low-level chronic exposures. Most studies have used considerably higher fields than are recommended for maximum permissible exposures for human occupational or environmental exposure. All studies in which effects have been observed have been above recommended maximum permissible exposure levels. Even at high levels, consistent morphological or organ abnormalities have not been reported. The most common observation at high exposures is a decrease in fetal mass which, by itself, may or may not have clinical importance. Research regarding teratogenic effects did not consistently produce effects that would lead investigators to suspect that RF exposure at or below the maximum permissible exposures to have embryopathic or teratogenic effects. Many other RF effects could be studied, but questions regarding teratogenic effects constitute one of the only areas in RF research that has been answered; namely, that RF exposure that have been studied present no teratogenic risk from exposures that do not exceed maximum permissible guidelines that are far below experimental teratogenic exposures to RF that have been reported.

### **A critical review of epidemiologic studies of radiofrequency exposure and human cancers.**

Elwood JM: *Environ Health Perspect* 1999; 107 : 155 - 168

This paper reviews studies that have assessed associations between likely exposure to radiofrequency (RF) transmissions and various types of human cancer. These studies include three cluster investigations and five studies relating to general populations; all of these studies consider place of residence at the time of cancer diagnosis in regard to proximity to radio or television transmitters. There are also five relevant occupational cohort studies and several case-control studies of particular types of cancer. These studies assessed a large number of possible associations. Several positive associations suggesting an increased risk of some types of cancer in those who may have had greater exposure to RF emissions have been reported. However, the results are inconsistent: there is no type of cancer that has been consistently associated with RF exposures. The epidemiologic evidence falls short of the strength and consistency of evidence that is required to come to a reasonable conclusion that RF emissions are a likely cause of one or more types of human cancer. The evidence is weak in regard to its inconsistency, the design of the studies, the lack of detail on actual exposures, and the limitations of the studies in their ability to deal with other likely relevant factors. In some studies there may be biases in the data used

### **Potential health risks of radiofrequency fields from wireless telecommunication devices.**

Krewski D, Byus CV, Glickman BW, Lotz WG, Mandeville R, McBride ML, Prato FS, Weaver DF: J Toxicol Environ Health B Crit Rev 2001; 4 (1): 1 - 143

Exposition

Mobilkommunikationssystem, analoges Mobiltelefon, digitales Mobiltelefon, Mobilfunk-Basisstation, PCS, Radio-/Fernsehsender, berufliche Exposition, häusliche Exposition

Endpunkte

Genotoxizität/Mutation: DNA-Schaden, Mutation

Zelllebensfähigkeit/Zellteilung/Zellproliferation: Zellproliferation

Zellfunktionen: Wirkung auf Calcium-Efflux, Ornithindecaboxylase, Polyamine, Blut-Hirn-Schranke

Krebs: Karzinogenität, Tumorpromotion; Leukämie, Brustkrebs, Krebs im Kindesalter

Effekte auf den Embryo/Fötus: angeborene Fehlbildungen

Effekte auf die Fortpflanzungsfähigkeit: Auswirkung auf die Nachkommen, Fehlgeburten

morphologische/histopathologische Veränderungen: Wirkung auf die Augen

endokrine Veränderungen: Melatonin-Sekretion

Effekte auf das neurologische System: neurologische Erkrankungen, Depression

Wirkungen auf Kognition/Verhalten: Wirkung auf das Verhalten, Autounfälle

Hypersensibilität/subjektive Beschwerden: Kopfschmerzen, Müdigkeit

Schlaf: Schlaf-Störungen

Epidemiologie: epidemiologische Evidenz, Expositions-Abschätzung, siehe "Krebs"

KEINE WEITEREN DATEN VORHANDEN

### **Safety issues in magnetic resonance imaging.**

Chung SM: J Neuroophthalmol 2002; 22 (1): 35 - 39

Although generally considered safe, magnetic resonance imaging (MRI) has a number of safety issues, including the effects of high magnetic fields and radiofrequency pulses on the body, and on implanted devices, the side effects of contrast agents, toxicity during pregnancy, claustrophobia, and hearing loss.

### **Epidemiological studies of radio frequency exposures and human cancer.**

Elwood JM: Bioelectromagnetics 2003; 24 : S63 - S73

Epidemiological studies of radio frequency (RF) exposures and human cancers include studies of military and civilian occupational groups, people who live near television and radio transmitters, and users of mobile phones. Many types of cancer have been assessed, with particular attention given to leukemia and brain tumors. The epidemiological results fall short of the strength and consistency of evidence that is required to come to a conclusion that RF emissions are a cause of human cancer. Although the epidemiological evidence in total suggests no increased risk of cancer, the results cannot be unequivocally interpreted in terms of cause and effect. The results are inconsistent, and most studies are limited by lack of detail on actual exposures, short follow-up periods, and the limited ability to deal with other relevant factors. In some studies, there may be substantial biases in the data used. For these same reasons, the studies are unable to confidently exclude any possibility of an increased risk of cancer. Further research to clarify the situation is justified. Priorities include further studies of leukemia in both adults and children, and of cranial tumors in relationship to mobile phone use.

### **Summary, conclusions and recommendations: adverse temperature levels in the human body.**

Goldstein LS, Dewhirst MW, Repacholi M, Kheifets L.: *Int J Hyperthermia* 2003; 19 (3): 373 - 384

In the spring of 2002, The World Health Organization workshop 'Adverse Temperature Levels in the Human Body' brought together scientists with expertise in biological effects of hyperthermia to review the data and determine the evidence that could be used to evaluate potential adverse effects from human exposures to radiofrequency (RF) electromagnetic radiation in the range of 10-300 GHz. Standards for RF exposure in this frequency range are based currently on thermal effects. Information was reviewed on the ability of hyperthermia, either to the whole body or to part of the body to affect physiology, particularly the heart and circulatory system, to induce other thermoregulatory responses such as sweating, to affect the performance of simple and complex mental tasks, to induce various heat-related disorders such as heat stroke and to damage body tissue. Risks to a variety of organs were considered. In addition, thresholds for effects on developing embryos and fetuses and possible carcinogenic effects were also examined. These findings were discussed in the context of known cellular and biochemical responses of cells and tissues to hyperthermia. The experts judged the relevance of each study for informing decision-makers on the scientific basis for establishing safe exposure levels. The consensus was that standards should consider both temperature and time of exposure, whenever possible.

### **Radiofrequency fields and teratogenesis.**

Heynick LN, Merritt JH: *Bioelectromagnetics* 2003: S174 - S186

Experimental studies that sought teratologic effects or developmental abnormalities from exposure to radiofrequency electromagnetic fields (RFEMF) in the range 3 kHz-300 GHz are critically reviewed for their possible consequences on human health. Those studies were conducted on beetles, birds, rodents, and nonhuman primates. Collectively, those experimental studies indicate that teratologic effects can occur only from exposure levels that cause biologically detrimental increases in body temperature. No reliable experimental evidence was found for nonthermal teratologic effects; rodents, mouse fetuses, and perinatal mice are more susceptible to such effects than rats. The primary confirmed effect in rats at high RFEMF levels was initial weight deficits in fetuses and neonates that decreased with infant growth. More generally from findings with pregnant mammals, exposures at RFEMF levels far higher than those permitted under the IEEE human exposure guidelines are necessary to reach or exceed cited experimental thresholds for maternal temperature increases. Some results indicated that the levels necessary to cause such effects in pregnant mammals could exceed those lethal to the dams. In a behavioral study of squirrel monkeys, no effects were observed on usual dam-offspring interactions or EEGs, but unexpected deaths of a number of offspring had occurred. However, this finding was not confirmed in a study solely on infant death using a larger number of subjects for greater statistical validity. Also reviewed were epidemiologic studies of various human populations considered to have been chronically exposed to environmental levels of RFEMF. Early studies on the incidence of congenital anomalies yielded no credible evidence that chronic exposure of pregnant women or of fathers exposed to RFEMF from nearby sources at levels below those guidelines would cause any anomalies in their offspring. The findings of studies on pregnancy outcomes of female physiotherapists occupationally exposed while treating patients with RFEMF were mixed, but taken collectively, the findings were negative.

### **Limitations of interview-based risk assessment of RF exposure from appliances.**

Behrens T, Terschuren C, Hoffmann W: *Arch Environ Health* 2004; 59 (6): 292 - 299

This study was conducted to assess the quality of interview-based exposure estimates obtained in a large epidemiologic case-control study: The Northern Germany Leukemia and Lymphoma Study (1997-2002) (NLL). The NLL used standardized, face-to-face, computer-assisted interviews to record subjects' lifetime use of radiofrequency (RF)-emitting appliances such as cellular telephones, cordless telephones, baby monitors, and television headphones. Exposure assessment comprised 3 levels of precision: ever use, gross vs. net appliance-years, and lifetime cumulative exposure hours. In the current study, the authors analyzed data from 3041 interviews of NLL controls, representing an age-stratified random sample of the general populations of 6 counties in Northern Germany. Weighted kappa coefficients for gross vs. net appliance-years for men were 0.59 (95% confidence interval [CI] = 0.46, 0.71) for baby monitors and 0.98 (95% CI = 0.97, 0.99) for cordless phones; for women, the coefficients were 0.68 (95% CI = 0.56, 0.79) and 0.97 (95% CI = 0.94, 0.98), respectively. Weighted kappa values were considerably lower when net appliance-years and lifetime cumulative exposure

hours were compared. Study results demonstrated that interview information on use of RF-emitting appliances, when measured at different levels of precision, can result in misclassification and biased risk estimates.

### **Electromagnetic fields and health effects--epidemiologic studies of cancer, diseases of the central nervous system and arrhythmia-related heart disease.**

Johansen C: *Scand J Work Environ Health* 2004; 30 : 1 - 30

This epidemiologic investigation comprised separate studies of the risk of cancer, cause-specific mortality rates, risks for neurodegenerative diseases, and the risk of arrhythmia-related heart disease among employees exposed to extremely low-frequency (50-Hz) electromagnetic fields (EMF) in the Danish utility industry. All the employees in this industry were followed-up in several registers. The risk of disease was analyzed in relation to occupational exposure to EMF, latency, and duration of employment. A specific job-exposure matrix was developed and validated by comparison with direct measurements of EMF during a workday. Linkage with the Danish Cancer Register did not identify increased risks for the cancers suggested a priori to be associated with exposure to EMF, including leukemia, brain tumors, and breast cancer. Significantly increased risks for lung cancer and mesothelioma were identified for workers highly exposed to asbestos. Linkage with the National Mortality Register revealed a significantly increased overall mortality rate from amyotrophic lateral sclerosis (ALS), with an increasing trend with duration of employment and EMF exposure. In addition, a significantly increased mortality rate from electric accidents was observed. It was hypothesized that the observation of increased mortality from ALS was associated with exposure to EMF or electric shocks. No increased mortality rate from cardiovascular or cerebrovascular disease was observed. Linkage with the National Hospital Register also revealed an increased risk of ALS and, thereby confirmed the finding of an increased mortality rate for this disease in the previous study. Linkage of the cohort with the Multiple Sclerosis Register revealed an increased risk of multiple sclerosis, which was not, however, significant. Linkage with the Pacemaker Register showed no increased risk of severe arrhythmia-related heart disease. The second part of the study included the establishment of a large, nationwide cohort of mobile phone subscribers comprising some 420 000 persons. No increased risk was observed for the cancers considered a priori to be possibly associated with the radiofrequency fields emitted by mobile phones, which were brain tumors, including acoustic neuroma, salivary gland tumors, and leukemia. The data were analyzed by duration of phone use, latency, system used (NMT, GSM or both) and age at first subscription. A study of the incidence of ocular malignant melanoma in comparison with the annual increase among the mobile phone subscribers showed a highly stable incidence rate for this rare cancer in Denmark over close to 50 years of registration. On the basis of these studies and the scientific literature, it is concluded that occupational exposure to 50-Hz EMF is not associated with an increased risk of cancer, but that these fields, electric shocks, or some other unknown factor related to alternating current electricity may be associated with the risk of ALS. There is no clear evidence that 50-Hz EMF is associated with other neurodegenerative or cardiovascular diseases. At present, there is little, if any, evidence that the use of mobile phones is associated with cancer in adults, including brain tumors, acoustic neuroma, cancer of the salivary glands, leukemia, or malignant melanoma of the eye.

### **Epidemiology of health effects of radiofrequency exposure.**

Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A: *Environ Health Perspect* 2004; 112 (17): 1741 - 1754

We have undertaken a comprehensive review of epidemiologic studies about the effects of radiofrequency fields (RFs) on human health in order to summarize the current state of knowledge, explain the methodologic issues that are involved, and aid in the planning of future studies. There have been a large number of occupational studies over several decades, particularly on cancer, cardiovascular disease, adverse reproductive outcome, and cataract, in relation to RF exposure. More recently, there have been studies of residential exposure, mainly from radio and television transmitters, and especially focusing on leukemia. There have also been studies of mobile telephone users, particularly on brain tumors and less often on other cancers and on symptoms. Results of these studies to date give no consistent or convincing evidence of a causal relation between RF exposure and any adverse health effect. On the other hand, the studies have too many deficiencies to rule out an association. A key concern across all studies is the quality of assessment of RF exposure. Despite the ubiquity of new technologies using RFs, little is known about population exposure from RF sources and even less about the relative importance of different sources. Other cautions are that mobile phone studies to date have been able to address only relatively short lag periods, that almost no data are

available on the consequences of childhood exposure, and that published data largely concentrate on a small number of outcomes, especially brain tumor and leukemia.

### **Mobile phones and children: is precaution warranted?**

van Rongen E, Roubos EW, van Aernsbergen LM, Brussaard G, Havenaar J, Koops FB, van Leeuwen FE, Leonhard HK, van Rhooon GC, Swaen GM, van de Weerd RH, Zwamborn AP.: *Bioelectromagnetics* 2004; 25 (2): 142 - 144

Are there health related arguments to recommend that children limit their use of mobile telephones? The International Expert Group on Mobile Phones from the UK concluded so, but did not come up with convincing scientific data to back this statement. The Health Council of the Netherlands approached the problem by considering whether developmental arguments might be found, i.e., asking if there reason to believe that the heads of children are more susceptible to the electromagnetic fields emitted by mobile telephones than those of adults. It concluded that no major changes in head development occur after the second year of life that might point at a difference in electromagnetic susceptibility between children and adults. The Health Council therefore sees no reason to recommend limiting the use of mobile phones by children.

Kommentar hierzu von Grigoriev Y: *Bioelectromagnetics* 2004; 25 (5): 322 – 323

### **Developmental effects of electromagnetic fields.**

Juutilainen J: *Bioelectromagnetics* 2005; 26 (S7): S107 - S115

This paper reviews experimental studies on the effects of radiofrequency (RF), extremely low frequency (ELF), and intermediate frequency (IF) electromagnetic fields on animal development. Numerous studies have shown that RF fields are teratogenic at exposure levels sufficiently high to cause significant increase of temperature. There is no consistent evidence of RF field effects at nonthermal exposure levels. Only a few studies have evaluated possible effects on postnatal development using sensitive endpoints, such as behavioral effects. ELF electric fields up to 150 kV/m have been evaluated in several mammalian species. The results are rather consistent and do not suggest adverse developmental effects. The results of studies on ELF magnetic fields suggest effects on bird embryo development, but not consistently in all studies. Results from experiments with other non-mammalian experimental models have also suggested subtle effects on developmental stability. In mammals, most studies have shown no effects of prenatal exposure to ELF or IF magnetic on gross external, visceral, or skeletal malformations. The only finding that shows some consistency is increase of minor skeleton alterations in several experiments. Taken as a whole, the results do not show robust adverse effects of ELF and IF fields on development. However, additional studies on the suggested subtle effects on developmental stability might increase our understanding of the sensitivity of biological organisms to weak low-frequency magnetic fields.

### **A review of the current use of magnetic resonance imaging in pregnancy and safety implications for the fetus.**

De Wilde JP, Rivers AW, Price DL: *Prog Biophys Mol Biol* 2005; 87 (2-3): 335 - 353

This paper presents an overview of the application of and risks of exposure to Magnetic Resonance Imaging (MRI) in pregnancy. It reviews the risks to the fetus by considering the hazards in terms of the three main components of an MRI system. These are the static magnetic field, the time-varying magnetic gradient fields and the pulsed radio frequency fields. The hazards discussed are biological effects, miscarriage, heating effects and acoustic noise exposure. This paper also presents a survey of MRI sites within the United Kingdom to ascertain the extent of MRI usage in pregnancy. To validate the situation of MRI in pregnancy a survey was sent to 352 MR units throughout the United Kingdom. The questions were grouped to assess (a) maternal MRI diagnosis (b) fetal MRI and (c) work practices for pregnant MRI staff. The results showed that 91% of sites were imaging pregnant women in need of diagnosis in the second and third trimester. This paper highlights that MRI can add information for fetal central nervous system abnormalities identified by ultrasound screening, however within the UK direct fetal imaging was only performed in 8% of sites. This paper indicates the need for research to be undertaken for specific MRI clinical conditions. It also advises that risk assessment for pregnant staff working in MRI is performed, and that there is a clear need for further research into the effects of MRI in pregnancy as there is a need for clear authoritative advice.

### **Electromagnetic safety of children using wireless phones: A literature review.**

Martens L: *Bioelectromagnetics* 2005; 26 (S7): S133 - S137

In this article, several issues related to the safety of electromagnetic field exposure of children when using wireless devices such as mobile phones are described. The information available in the literature is reviewed and open areas that need to be subject of future research are identified. A lack of proof that dielectric properties change with age and an inconsistency in absorption studies in children is reported. The number of biological studies relevant to children is limited. Only some of the cognitive studies specifically target children and these show no significant effect of exposure. There is also a need to investigate the impact of electromagnetic fields on the developmental process of children. All this makes a definitive answer to the question if children are more sensitive to electromagnetic fields than adults impossible. More consistent research will be needed. This study is part of the European COST281 project "Potential Health Implications from Mobile Communication Systems."

### **Electrosmog, cellular phones, sunbeds etc. -- adverse health effects from radiation? Health aspects of non-ionizing radiation]**

Bernhardt JH: Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 2005; 48 (1): 63 - 75  
This review supplies a survey of the three physical influences, i. e. UV radiation, high-frequency electromagnetic fields of radio telephone systems and other wireless radio applications as well as low-frequency fields of electric power supply. The exposure to UV radiation must be considered to be by far the highest health risk. The annual rate of about 2000 deaths from skin cancer in Germany, mainly caused by extensive exposure to solar UV radiation, demands protective measures. Teaching reasonable behaviour is the supreme issue. Recommended protective measures in the order of their effectiveness are protection by adaptation of behaviour, by clothes, sun hats and sunglasses as well as by sun creams. Children are the most important target group. With regard to UV tanning appliances it is recommended not to use artificial UV radiation for cosmetic purposes because of the related health risks. For the assessment of health impairments caused by exposure to electromagnetic fields, direct field reactions due to induced electric body currents, reactions on the surface of the body or heating effects should be separated from indirect field reactions (e. g. electric shocks and burns) due to contact currents or interference with electronic body aids and implants. Risk assessment has led to recommendations of threshold values which-in agreement with international research results-exclude all impairments of health caused by direct field reactions scientifically proven to date. Contrary to public concerns, which are mostly related to base transmitters of radio telephone systems, exposure due to handheld radio telephones (cellular phones) should rather be considered from the viewpoint of precautionary health protection, since it is more likely that their use can lead to high exposure of the user. Due to the protective measures provided so far and observance of the threshold values based on scientific results, exposures do not lead to health impairments-not even in children. Because of the introduction of new technologies more portable devices are to be expected that may be operated near the body. This will further increase the exposure of people to high-frequency electromagnetic fields.

### **Sensitivity of children to EMF exposure - do elevated susceptibilities to high-frequency mobile communication fields exist during discrete developmental phases?**

Reissenweber J, Poess J, David E:  
Edition Wissenschaft 2005; 22 : 1 - 42 (Journal nicht Peer-Reviewed)

### **Developmental effects of physiologically weak electric fields and heat: An overview.**

Saunders RD, McCaig CD: Bioelectromagnetics 2005; 26 (S7): S127 - S132  
This study summarizes the possible effects on prenatal development of physiologically weak electric fields induced in the body by exposure to extremely low frequency (ELF) electromagnetic fields and of elevated temperature levels that might result from exposure to radiofrequency (RF) radiation. Both topics have been discussed at recent international workshops organized by WHO in collaboration with other bodies. Mammalian development is characterized by a highly ordered sequence of cell proliferation and differentiation, migration, and programmed cell death. These processes, particularly proliferation and migration, are susceptible to a variety of environmental agents including raised maternal temperature. In addition, there is growing evidence that physiologically weak endogenous DC electric fields and ionic currents have a role in guiding developmental processes, including cell orientation and migration, by establishing electrical potential gradients. Disruption of these fields can adversely affect development in amphibian and bird embryos, which are experimentally accessible, and may well do so in mammalian embryos. The extent to which induced ELF electric fields might influence these and other processes that take place during prenatal development, childhood, and adolescence is less clear. Organogenesis, which takes place primarily during the embryonic period, is

susceptible to raised maternal temperatures; a large number of studies have shown that RF exposure produces developmental effects that can be attributed to heat. The development of the central nervous system is particularly susceptible to raised temperatures; a reduction in brain size, which results in a smaller head, is one of the most sensitive markers of heat-induced developmental abnormalities and can be correlated with heat-induced behavioral deficits. However, some aspects of CNS development have been less well explored, particularly effects on corticogenesis. In addition, the persistence of CNS developmental sensitivity through to childhood and adolescence is not clear.

### **Mobile phone use and exposures in children**

Schüz, J.: *Bioelectromagnetics* 2005; 26 (S7): 45 - 50

The main difference concerning the use of mobile phones (MPs) between today's children and adults is the longer lifetime exposure of children when they grow older, due to starting to use MPs at an early age. Additionally, recent trends lead to a higher frequency of use among children, including higher popularity of MPs and features specifically designed to attract children. The prevalence of MP users is already very high and reaches >90% among adolescents in some countries. In a German study, 6% of 9-10 years old children used a MP for making calls daily; 35% owned their own MP. For children, MPs are dominant sources of radio wave exposures and relevant sources of extremely low frequency magnetic fields. For very young children, however, environmental exposure to radio waves may be of concern. In conclusion, children will have a much higher cumulative exposure to radio waves than today's adults when they are at the same age. Radio wave exposure of children may be estimated more easily, because the variety of exposure sources is smaller than for adults. As long as adverse health effects cannot be ruled out with some degree of certainty, it appears to be appropriate to instruct children and their parents about a prudent use of MPs.

### **Childhood leukemia and EMF: Review of the epidemiologic evidence.**

Kheifets L, Shimkhada R.: *Bioelectromagnetics* 2005; 26 (S7): 51 - 59

All populations are exposed to varying degrees of electromagnetic fields (EMF); in this study we consider only extremely low frequency (ELF) and radio frequency (RF) fields. After the first study of ELF and childhood leukemia in 1979, intensive epidemiologic investigation has sought to shed light on the potential relation between EMF and childhood leukemia. Consistent associations from epidemiologic studies and two pooled analyses have been the basis for the classification of ELF as a possible carcinogen by the International Agency for Research on Cancer (IARC). The study of RF is still in its infancy and little is known about residential RF exposure or its potential effects on childhood leukemia. The purpose of this study, presented at the WHO Workshop on Sensitivity of Children to EMF in Istanbul, Turkey in June 2004, is to review and critically assess the epidemiologic evidence on EMF and childhood leukemia.

### **The sensitivity of children to electromagnetic fields.**

Kheifets L, Repacholi M, Saunders R, van Deventer E: *Pediatrics* 2005; 116 (2): e303 - e313

In today's world, technologic developments bring social and economic benefits to large sections of society; however, the health consequences of these developments can be difficult to predict and manage. With rapid advances in electromagnetic field (EMF) technologies and communications, children are increasingly exposed to EMFs at earlier and earlier ages. Consistent epidemiologic evidence of an association between childhood leukemia and exposure to extremely low frequency (ELF) magnetic fields has led to their classification by the International Agency for Research on Cancer as a "possible human carcinogen." Concerns about the potential vulnerability of children to radio frequency (RF) fields have been raised because of the potentially greater susceptibility of their developing nervous systems; in addition, their brain tissue is more conductive, RF penetration is greater relative to head size, and they will have a longer lifetime of exposure than adults. To evaluate information relevant to children's sensitivity to both ELF and RF EMFs and to identify research needs, the World Health Organization held an expert workshop in Istanbul, Turkey, in June 2004. This article is based on discussions from the workshop and provides background information on the development of the embryo, fetus, and child, with particular attention to the developing brain; an outline of childhood susceptibility to environmental toxicants and childhood diseases implicated in EMF studies; and a review of childhood exposure to EMFs. It also includes an assessment of the potential susceptibility of children to EMFs and concludes with a recommendation for additional research and the development of precautionary policies in the face of scientific uncertainty.

### **Non-cancer EMF effects related to children**

Feychting M: *Bioelectromagnetics* 2005; 26 (S7): S69 - S74

Potential adverse effects of electromagnetic field exposure on the developing child have been discussed during the last decades. Effects during fetal development could have major consequences and possibly lead to various adverse pregnancy outcomes. This study summarizes the evidence on adverse pregnancy outcomes in relation to extremely low frequency (ELF) and radiofrequency (RF) exposures and briefly discusses other potential health effects, excluding cancer, following childhood exposures to these fields. Most studies of ELF exposures have not demonstrated any consistent risk increases for adverse pregnancy outcomes, but limitations in the exposure assessment methods and very limited power to study high exposure levels prevents any conclusions. Findings of an increased risk of spontaneous abortion in relation to maximum magnetic field exposures in two studies need to be confirmed. Studies of RF exposure have mostly been limited to physiotherapists and although some positive findings have been reported, no specific type of malformation or other adverse outcome has been consistently reported. Different types of symptoms and effects on cognitive function in relation to both ELF and RF fields have been reported in adults, but scientific studies have not confirmed that these symptoms are caused by the electromagnetic fields. No information is available for children.

### **EMF and health.**

Feychting M, Ahlbom A, Kheifets L.: *Annu Rev Public Health* 2005; 26 : 165 - 189

Electric and magnetic fields are ubiquitous in the modern society, and concerns have been expressed regarding possible adverse effects of these exposures. This review covers epidemiologic research on health effects of exposures to static, extremely low-frequency (ELF), and radio frequency (RF) fields. Research on ELF fields has been performed for more than two decades, and the methodology and quality of studies have improved over time. Studies have consistently shown increased risk for childhood leukemia associated with ELF magnetic fields, whereas ELF fields most likely are not a risk factor for breast cancer and cardiovascular disease. There are still inadequate data for other outcomes. More recently, focus has shifted toward RF exposures from mobile telephony. There are no persuasive data suggesting a health risk, but this research field is still immature with regard to the quantity and quality of available data. This technology is constantly changing and there is a need for continued research on this issue. Almost no epidemiologic data are available for static fields.

### **How dangerous are mobile phones, transmission masts, and electricity pylons?**

Wood AW: *Arch Dis Child* 2006; 91 (4): 361 - 366

Electrical power and mobile communications deliver enormous benefit to society, but there are concerns whether the electric and magnetic field (EMF) emissions associated with the delivery of this benefit are linked to cancer or other health hazards. This article reviews the strength of the available epidemiological and laboratory evidence and notes that this falls short of what is normally required to establish a causal link. However, because of scientific uncertainty a cautious approach is often advocated, but here, too, there may be a tendency to judge these risks more harshly than those in other areas with similar strength of evidence.

### **Can EMF exposure during development leave an imprint later in life?**

Blackman CF.: *Electromagn Biol Med* 2006; 25 (4): 217 - 225

People in industrialized nations live in an environment of ubiquitous electromagnetic field (EMF) exposure, both natural and anthropogenic. The intensity, variety, and geographic distribution of anthropogenic EMF exposures have grown dramatically since the mid 20th century, with many uses serving, and in close proximity to, human populations, such as electric power distribution, radio and television transmission, and more recently, personal cell phone communication units and transmitting towers. Thus, it is reasonable to ask if this EMF exposure could cause alterations in the physiology of developing organisms, since they are generally assumed to be the most sensitive to chemical stressors. In this report, we review work published beginning in the late 1980s. Initial reports indicated that exposure of chicken eggs during embryonic development to power-line electric fields of 50 and 60 Hz, at 10 V/m in air (which is frequently in locations inhabited by humans), could cause the brain tissues of the hatched chickens to respond differently in a particular test. More recently, an anecdotal report of human sensitivity to EMF has appeared that shows a health-related influence of prior exposure history to particular power-line frequencies in chemically sensitized individuals. These reports open the question of whether the ambient electromagnetic environment can leave an imprint on developing organisms and if such imprint changes have the potential for health consequences.

## **Electromagnetic fields (EMF): Do they play a role in children's environmental health (CEH)?**

Otto M, von Muhlendahl KE: *Int J Hyg Environ Health* 2007; 210 (5): 635 - 644

Possible adverse health effects of exposure to electric, magnetic and electromagnetic fields (EMF), and especially the question of whether there exists a special vulnerability of children, have been a much discussed topic during the last two decades. Static fields produce health effects only in very rare and exceptional circumstances at extremely high field intensities. As for low-frequency EMF, the results of epidemiological research with respect to childhood leukaemia prompted the International Agency for Research on Cancer (IARC) in 2001 to classify these fields as "possibly carcinogenic to humans". Current hypotheses on the mechanism of such action are presented. The effect, if existent, appears to be not very important in relation to established other causes of childhood leukaemia. High-frequency EMF, as used in mobile and wireless communication (mobile telephony according to the GSM and UMTS standard, cordless DECT phones, wireless local area networks (WLAN), Bluetooth) and since many decades also in radio and television technology, are practically omnipresent. At high intensities, the generation of heat is the principal effect. Current guidelines, limits and regulations prevent any such effect. Mobile phone calls may, in certain circumstances, lead to local exposures close to limit values. Base stations typically produce exposures lower by 2-5 magnitudes. The discussion centres on the so-called non-thermal effects, which are supposedly occurring at field intensities, which are by orders of magnitude lower than those responsible for thermal effects. The reproducibility of these effects is usually poor, and no physiologic or pathogenic mechanism, so far, has been found to explain the alleged effects. Equally, epidemiologic studies have not furnished clear and reproducible data as arguments for negative health effects. Final results of the INTERPHONE study on the risk of brain tumours, acoustic neurinoma and parotid gland tumours associated with the use of mobile phones will be soon available. Preliminary results do not seem to indicate a substantial increase in risk. There are presently no scientific data supporting the concept of a special vulnerability of children and adolescents to high-frequency EMF, even if the usual caveats (developing organisms and structures may be more vulnerable, decades of life to come) are considered. The concept of precautionary measures adapted to such concerns is critically discussed.

## **Environmental hazards: evidence for effects on child health.**

Wigle DT, Arbuckle TE, Walker M, Wade MG, Liu S, Krewski D.: *J Toxicol Environ Health B Crit Rev* 2007; 10 (1-2): 3 - 39

The human fetus, child, and adult may experience adverse health outcomes from parental or childhood exposures to environmental toxicants. The fetus and infant are especially vulnerable to toxicants that disrupt developmental processes during relatively narrow time windows. This review summarizes knowledge of associations between child health and development outcomes and environmental exposures, including lead, methylmercury, polychlorinated biphenyls (PCBs), dioxins and related polyhalogenated aromatic hydrocarbons (PHAHs), certain pesticides, environmental tobacco smoke (ETS), aeroallergens, ambient air toxicants (especially particulate matter [PM] and ozone), chlorination disinfection by-products (DBPs), sunlight, power-frequency magnetic fields, radiofrequency (RF) radiation, residential proximity to hazardous waste disposal sites, and solvents. The adverse health effects linked to such exposures include fetal death, birth defects, being small for gestational age (SGA), preterm birth, clinically overt cognitive, neurologic, and behavioral abnormalities, subtle neuropsychologic deficits, childhood cancer, asthma, other respiratory diseases, and acute poisoning. Some environmental toxicants, notably lead, ionizing radiation, ETS, and certain ambient air toxicants, produce adverse health effects at relatively low exposure levels during fetal or child developmental time windows. For the many associations supported by limited or inadequate epidemiologic evidence, major sources of uncertainty include the limited number of studies conducted on specific exposure-outcome relationships and methodologic limitations. The latter include (1) crude exposure indices, (2) limited range of exposure levels, (3) small sample sizes, and (4) limited knowledge and control of potential confounders. Important knowledge gaps include the role of preconceptional paternal exposures, a topic much less studied than maternal or childhood exposures. Large longitudinal studies beginning before or during early pregnancy are urgently needed to accurately measure and assess the relative importance of parental and childhood exposures and evaluate relatively subtle health outcomes such as neuropsychologic and other functional deficits. Large case-control studies are also needed to assess the role of environmental exposures and their interactions with genetic factors in relatively uncommon outcomes such as specific types of birth defects and childhood cancers. There is also an urgent need to accelerate development and use of biomarkers of exposure and genetic susceptibility in epidemiologic studies. This review supports the

priority assigned by international agencies to relationships between child health and air quality (indoor and outdoor), lead, pesticides, water contaminants, and ETS. To adequately address such priorities, governments and agencies must strengthen environmental health research capacities and adopt policies to reduce parental and childhood exposures to proven and emerging environmental threats.

### **Lifestyle-related factors and environmental agents causing cancer: an overview.**

Irigaray P, Newby JA, Clapp R, Hardell L, Howard V, Montagnier L, Epstein S, Belpomme D.: *Biomed Pharmacother* 2007; 61 (10): 640 - 658

The increasing incidence of a variety of cancers after the Second World War confronts scientists with the question of their origin. In Western countries, expansion and ageing of the population as well as progress in cancer detection using new diagnostic and screening tests cannot fully account for the observed growing incidence of cancer. Our hypothesis is that environmental factors play a more important role in cancer genesis than it is usually agreed. (1) Over the last 2-3 decades, alcohol consumption and tobacco smoking in men have significantly decreased in Western Europe and North America. (2) Obesity is increasing in many countries, but the growing incidence of cancer also concerns cancers not related to obesity nor to other known lifestyle-related factors. (3) There is evidence that the environment has changed over the time period preceding the recent rise in cancer incidence, and that this change, still continuing, included the accumulation of many new carcinogenic factors in the environment. (4) Genetic susceptibility to cancer due to genetic polymorphism cannot have changed over one generation and actually favours the role of exogenous factors through gene-environment interactions. (5) Age is not the unique factor to be considered since the rising incidence of cancers is seen across all age categories, including children, and adolescents. (6) The fetus is specifically vulnerable to exogenous factors. A fetal exposure during a critical time window may explain why current epidemiological studies may still be negative in adults. We therefore propose that the involuntary exposure to many carcinogens in the environment, including microorganisms (viruses, bacteria and parasites), radiations (radioactivity, UV and pulsed electromagnetic fields) and many xenochemicals, may account for the recent growing incidence of cancer and therefore that the risk attributable to environmental carcinogen may be far higher than it is usually agreed. Of major concern are: outdoor air pollution by carbon particles associated with polycyclic aromatic hydrocarbons; indoor air pollution by environmental tobacco smoke, formaldehyde and volatile organic compounds such as benzene and 1,3 butadiene, which may particularly affect children and food contamination by food additives and by carcinogenic contaminants such as nitrates, pesticides, dioxins and other organochlorines. In addition, carcinogenic metals and metalloids, pharmaceutical medicines and some ingredients and contaminants in cosmetics may be involved. Although the risk fraction attributable to environmental factors is still unknown, this long list of carcinogenic and especially mutagenic factors supports our working hypothesis according to which numerous cancers may in fact be caused by the recent modification of our environment.

### **The multitude and diversity of environmental carcinogens.**

Belpomme D, Irigaray P, Hardell L, Clapp R, Montagnier L, Epstein S, Sascio AJ: *Environ Res* 2007; 105 (3): 414 - 429

We have recently proposed that lifestyle-related factors, screening and aging cannot fully account for the present overall growing incidence of cancer. In order to propose the concept that in addition to lifestyle related factors, exogenous environmental factors may play a more important role in carcinogenesis than it is expected, and may therefore account for the growing incidence of cancer, we overview herein environmental factors, rated as certainly or potentially carcinogenic by the International Agency for Research on Cancer (IARC). We thus analyze the carcinogenic effect of microorganisms (including viruses), radiations (including radioactivity, UV and pulsed electromagnetic fields) and xenochemicals. Chemicals related to environmental pollution appear to be of critical importance, since they can induce occupational cancers as well as other cancers. Of major concerns are: outdoor air pollution by carbon particles associated with polycyclic aromatic hydrocarbons; indoor air pollution by environmental tobacco smoke, formaldehyde and volatile organic compounds such as benzene and 1,3 butadiene, which may particularly affect children, and food pollution by food additives and by carcinogenic contaminants such as nitrates, pesticides, dioxins and other organochlorines. In addition, carcinogenic metals and metalloids, pharmaceutical medicines and cosmetics may be involved. Although the risk fraction attributable to environmental factors is still unknown, this long list of carcinogenic and especially mutagenic factors supports our working hypothesis according to which numerous cancers may in fact be caused by the recent modification of our environment.

## **Exposure assessment and other challenges in non-ionizing radiation studies of childhood leukaemia.**

Kheifets L, Oksuzyan S.: Radiat Prot Dosimetry 2008; 132 (2): 139 - 147

Studies of electromagnetic fields (EMF) and the development of childhood leukaemia face unique difficulties. EMF are imperceptible, ubiquitous, have multiple sources, and can vary greatly over time and distances. Childhood leukaemia and high average exposures to magnetic fields are both quite rare. Thus, a major challenge in EMF epidemiology is the small number of highly exposed cases and the necessity for retrospective assessment of exposure. Only studies designed to minimize bias while maximizing our ability to detect an association, should one exist, would have a potential to contribute to our understanding. New approaches are needed; the most promising in the extremely low-frequency range involves a study of a highly exposed cohort of children who have lived in apartments next to built-in transformers or electrical equipment rooms. Another promising avenue is an investigation of possible joint effects of environmental exposures and genetic co-factors. An exposure assessment methodology for residential radiofrequency fields is still in its infancy. Rapid changes in technology and exponential increases in its use make exposure assessment more difficult and urgent.

## **Exposure to electromagnetic fields and the risk of childhood leukaemia: a review.**

Schüz J, Ahlbom A: Radiat Prot Dosimetry 2008; 132 (2): 202 – 211

Extremely low-frequency magnetic fields have been classified as possibly carcinogenic to humans, mainly based on epidemiological studies consistently showing an association between long-term average exposures to magnetic fields above 0.3/0.4 microT and the risk of childhood leukaemia. No mechanism to explain this finding has been established and no support for a causal link emerged from experimental studies. Chance or bias cannot be ruled out with reasonable confidence as an explanation for the observed association. If the association is causal, it explains only a small fraction of childhood leukaemia cases. There were some reports of childhood leukaemia clusters in the vicinity of high-power radio and television broadcast transmitters in studies in Australia and Italy. However, recent large-scale systematic studies in Korea and Germany show no association between exposure to radio frequency electromagnetic fields emitted from broadcast towers and childhood leukaemia risk. Studies on mobile phone use and leukaemia risk in adolescents and young adults may be indicated.

## **Extrakte aus Reports und Statements (chronologisch gelistet)**

### *Übersicht*

- [National Cancer Institute, USA](#), 2009
- [SCENIHR \(Scientific Committee on Emerging and Newly Identified Health Risks\)](#), 2009
- [ICNIRP \(International Commission on non-ionizing radiation protection\)](#), 2009
- [U.S. Department for Food and Drug Administration \(FDA\), USA](#), 2009
- [WBF \(Wissenschaftlicher Beirat Funk\), Österreich](#), 2009
- [STUK \(Finnish Radiation and Nuclear Safety Authority\), Finnland](#), 2009
- [CCARS \(Comité científico asesor en radiofrecuencias y salud\), Spanien](#), 2009
- [BfS \(Bundesamt für Strahlenschutz\), Deutschland](#), 2008
- [BUND \(Bund für Umwelt und Naturschutz\), Deutschland](#), 2008
- [SSK \(Strahlenschutzkommission\), Deutschland](#), 2008
- [Arpansa \(Australian Radiation Protection and Nuclear Safety Agency\), Australien](#), 2008
- [SSI \(Swedish Radiation Protection Institute\), Schweden](#), 2007
- [BAFU \(Bundesamt für Umwelt\), Schweiz](#), 2007
- [Bioinitiative-Report, USA](#), 2007
- [IZMF \(Informationszentrum für Mobilfunk\), Deutschland](#), 2007, 2009
- [MTHR \(Mobile Telecommunications and Health Research Programme\), UK](#), 2007
- [Department of Communications, Marine and Natural Resources, Ireland](#), 2007
- [AFSSET \(Agence Française de Sécurité Sanitaire de l'Environnement et du Travail\), Frankreich](#), 2005
- [WHO \(World Health Organization\)](#), 2004
- [NRPB \(National Radiological Protection Board, UK\), nowadays HPA \(Health Protection Agency\), UK](#), 2004
- [HCN \(Health Council of the Netherlands\), Niederlande](#), 2002, 2008

- [Australian Mobile Telecommunications Association \(AMTA\), Australien, 200 ?](#)
- [STEWART-Report 2000, UK, 2000](#)

### *Relevante Extrakte*

- **National Cancer Institute, USA**

“Cellular Telephone Use and Cancer Risk”, **September 2009**  
<http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones>

Do children have a higher risk of developing cancer due to cellular telephone use than adults? There are currently no data on cellular telephone use and risk of cancer in children because no published studies to date have included children. Cellular telephone use is increasing rapidly in children and adolescents, and they are likely to accumulate many years of exposure during their lives (Ahlbom 2004). In addition, children may be at greater risk because their nervous systems are still developing at the time of exposure. A large case-control study of childhood brain cancer in several Northern European countries is in progress.

- **SCENIHR (Scientific Committee on Emerging and Newly Identified Health Risks)**

“Research needs and methodology to address the remaining knowledge gaps on the potential health effects of EMF”, **Juli 2009**  
[http://ec.europa.eu/health/ph\\_risk/committees/04\\_scenihhr/docs/scenihhr\\_o\\_024.pdf](http://ec.europa.eu/health/ph_risk/committees/04_scenihhr/docs/scenihhr_o_024.pdf)

Research recommendations: .... Children are exposed to RF fields from mobile telecommunications equipment earlier and thus have longer life-time exposure than present day adults. They may also be more susceptible than adults due to anatomical and morphological differences and as they are exposed during development. Available and ongoing research is mainly limited to case control studies on childhood brain tumours. Hardly any research has been done on the effects of exposure to EMF on the development of the central nervous system, on cognitive functions in children, and on behaviour. More data are also needed on children younger than those who have been studied to date. Animal experiments on early brain and behaviour development can answer some of the questions related to effects on children. ...

The dosimetry study should consider:

- The relation between exposure and SAR (to ensure protectiveness of reference levels).
- Both near field and far field exposure, and partial and whole body exposure.
- Use available sets of phantoms.
- Moreover, exposure patterns typical of children and adolescents should be investigated, and thus not only the exposure arising from mobile phone use in the talk mode (e.g. SMS or use of RF field transmitting toys etc.).

For epidemiological studies in children (different age groups), the following features have to be considered:

- Feasibility studies need to be performed initially due to a lack of adequate study setups for children.
- Exposure assessment is more difficult than in adults as children are not the owners of their mobile phones.
- When a broad age range is covered, questionnaires must be both applicable to young and older children and, most likely, interviews have also to be performed with the parents.

It is furthermore recommended that an epidemiological study should focus on both behavioural problems and cognitive development in children, especially since the ongoing case-control studies MOBIKIDS11 and CEFALO12 already address the question of cancer.

"Health Effects of Exposure to EMF", **Januar 2009**

[http://ec.europa.eu/health/ph\\_risk/committees/04\\_scenihhr/docs/scenihhr\\_o\\_022.pdf](http://ec.europa.eu/health/ph_risk/committees/04_scenihhr/docs/scenihhr_o_022.pdf)

*Abstract:* ....From the risk assessment perspective it is important to recognise that information on possible effects caused by RF fields in children is limited. Furthermore, there is a lack of information on diseases other than those discussed in this report. ....

*Radio and television broadcast transmitters and childhood leukaemia:*..... New improved studies on the association between RF fields from broadcast transmitters and childhood cancer provide evidence against such an association. .... However, no studies on mobile and cordless phone use among children and adolescents have been completed so far. ....

*Reproduction and development:* .... Recent studies have not shown effects from RF fields on human or animal reproduction and development. No new data have appeared that indicate any other effects on human health. ....

*Dosimetric aspects:* There are conflicting opinions regarding possible differences in RF absorption between children and adults during mobile phone usage (Wiert et al. 2005, Christ and Kuster 2005b). ... The exposure of possibly sensitive groups of the population such as children should be investigated using adequate numerical phantoms taking multi-source and multi-path exposure conditions into account. Finally, such investigations should not be restricted to the radio frequency range only.

*Research Recommendations:*

To date no specific study on children exists. ...One way to address this is by studies on immature animals. This research has to take into consideration that dosimetry in children may differ from that in adults.

"Possible effects of Electromagnetic Fields (EMF) on Human Health", **März 2007**

[http://ec.europa.eu/health/ph\\_risk/committees/04\\_scenihhr/docs/scenihhr\\_o\\_007.pdf](http://ec.europa.eu/health/ph_risk/committees/04_scenihhr/docs/scenihhr_o_007.pdf)

*Opinion from 2001:*

In particular, in humans, no evidence of carcinogenicity in either children or adults has resulted from epidemiological studies (the size of some of which was very large, although the period of observation was not long enough for a definitive statement).

*Updated Opinion 2007:*

A particular consideration is mobile phone use by children. While no specific evidence exists, children or adolescents may be more sensitive to RF field exposure than adults in view of their continuing development. Children of today may also experience a much higher cumulative exposure than previous generations. To date no epidemiologic studies on children are available.

*Research Recommendations:*

In view of the identified important gaps in knowledge the following research recommendations are being made.

Health effects of RF exposure in children. To date no study on children exists. This issue can also be addressed by studies on immature animals. This research has to take into consideration that dosimetry in children may differ from that in adults.

....

- **ICNIRP (International Commission on non-ionizing radiation protection)**

"Exposure to high frequency electromagnetic fields, biological effects and health consequences (100 kHz-300 GHz)", **2009**

<http://www.icnirp.de/documents/RFReview.pdf>

*Die derzeitige Datenlage zu diesem Thema wird für eine abschließende Bewertung als unzureichend angesehen. Es wird auf die Notwendigkeit weiterer Forschung im Hinblick auf die dosimetrischen Verhältnisse sowie weiterer Experimente am Objekt mehrfach hingewiesen.*

*Summary/Conclusion:* ....The experimental data do not suggest so far that children are more susceptible than adults to RF radiation, but few relevant studies have been conducted. .... Regarding possible mobile phone type RF effects on EEG and cognitive function in children and adolescents, there is overall no robust evidence of any effect. ....

*Dosimetrie:* ..... The age dependence aspect is also of relevance for dosimetry and risk assessment. It is found that the permittivity and conductivity of tissues are higher for young rats than for adult ones. Recent studies using realistic whole-body voxel models of children suggest that the whole-body averaged SAR can be higher for children than for adults. However, significant differences in SAR average over 10 g due to a cellular phone have not been found between child and adult head models in a multi-laboratory collaboration study, although some research suggest the possibility of significant increase of the child head SAR. It remains possible that the distribution of absorption within the child and adult head may be different. Pregnant female voxel models have also been developed recently. Although most of the calculated SAR of the fetus or embryo models are similar or lower than that of the mother, temperature simulation is required for a more comprehensive risk assessment of RF exposure of fetuses and embryos. ...

Dosimetry for children, fetuses, and embryos: The establishment of a database for children's dielectric properties should be an essential and urgent task. .... However, a majority of the SARs were higher in the child than the adult model, especially for the 835 MHz phone in tilt position when normalized to antenna current. .... More detailed calculations, it would require more knowledge of dosimetric parameters of pregnant females and fetuses. Note that Kawai et al (2006) reported that the conductivity of rabbit fetuses is 1.3 times of that of muscle at 150 MHz. The same situation is true for temperature simulation because the thresholds of thermal effects in fetuses and embryos have not been established in terms of SAR.

*Reproduktion und Entwicklung:* ... Numerous studies have evaluated developmental and reproductive effects of RF exposure on mammals and birds. These studies have clearly shown that RF exposure can cause increased embryo and fetal losses, increased incidence of fetal malformations and anomalies, reduced fetal weight at term and impair male fertility at exposure levels that are sufficiently high to cause significant increase of temperature. There is no consistent evidence of adverse effects at *non-thermal* exposure levels. Relatively few studies have evaluated possible effects of prenatal exposure on postnatal development; results from such studies have not shown consistent effects on developmental indices or behavior at exposure levels that do not induce hyperthermia. The possibility of effects resulting from long-term RF exposure during the development of neonatal and juvenile animals has been addressed in only a few studies. Some effects on brain development have been reported, but additional experiments would be needed to confirm their reproducibility and to understand their biological significance. ...

- **FDA (U.S. Department for Food and Drug Administration)**

"Children and Cell Phones", 2009

<http://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116331.htm>

*Es gibt keine wissenschaftlichen Hinweise, dass die elektromagnetischen Felder von Mobiltelefonen eine Gefahr für den Benutzer darstellen, egal welcher Altersgruppe.*

The scientific evidence does not show a danger to any users of cell phones from RF exposure, including children and teenagers. The steps adults can take to reduce RF exposure apply to children and teenagers as well.

- Reduce the amount of time spent on the cell phone

- Use speaker mode or a headset to place more distance between the head and the cell phone.

Some groups sponsored by other national governments have advised that children be discouraged from using cell phones at all. For example, The Stewart Report from the United Kingdom made such a recommendation in December 2000. In this report a group of independent experts noted that no evidence exists that using a cell phone causes brain tumors or other ill effects. Their recommendation to limit cell phone use by children was strictly precautionary; it was not based on scientific evidence that any health hazard exists.

- **WBF (Wissenschaftlicher Beirat Funk), Österreich**

WBF-Expertenforum 2009, **April 2009**

<http://www.wbf.or.at/wbf-expertenforum/expertenforum-2009/expertenkonsens-2009/>

“ Es gibt keine Ergebnisse zu einem möglichen Zusammenhang zwischen Exposition und Gesundheitsbeeinträchtigung bei Kindern.”

Ist mobiles Telefonieren schädlich für Kinder? (2008)

<http://www.wbf.or.at/mobilfunk/>

...

„Die Frage, ob und inwieweit Mobilfunk die Gesundheit des kindlichen Organismus im Speziellen beeinträchtigt, kann nach dem heutigen Stand der Wissenschaft nicht seriös beantwortet werden. Mit einschlägigen Untersuchungen auf diesem Gebiet haben internationale Forschergruppen erst vor kurzem begonnen. Zusätzlich stellt sich hier das Problem, dass Studien mit Kindern und Jugendlichen in vielen Staaten aus ethischen Gründen verboten sind.“

...

- **STUK (Finnish Radiation and Nuclear Safety Authority), Finland**

“Statement of Finnish Radiation and Nuclear Safety Authority (STUK) concerning mobile phones and health on 7<sup>th</sup> January 2009”, updated **23.04.2009**

[http://www.stuk.fi/sateilytietoa/sateilyn\\_terveysvaikutukset/matkapuhelin\\_terveysvaikutus/en\\_GB/stukin\\_matkapuhelinkannanotto/](http://www.stuk.fi/sateilytietoa/sateilyn_terveysvaikutukset/matkapuhelin_terveysvaikutus/en_GB/stukin_matkapuhelinkannanotto/)

There is only scarce research evidence on children and mobile phones, and it is not easy to get more – in research ethical sense, children are a special group, which is why the intended study must be very well-founded. Research evidence is neither available on young people's using habits of mobile phones. Studies have been made with young test animals but these results are not directly applicable to humans.

Children nevertheless have a special status as mobile phone users, among others, because brains continue to develop even up to 20 years of age. It should also be taken into account that children will have much more time to use mobile phones than adults today who started their regular mobile phone use only about ten years ago. The risk of long-term use of mobile phones cannot however be assessed with certainty until mobiles phones have been in use for several decades.

STUK does not find it justifiable to totally prohibit children's use of mobile phones. Mobile phones also create safety because they make children's communication with parents easier.

If an adult person is concerned about his/her own exposure to RF radiation, it is possible to reduce the exposure accordingly as explained above in connection of children.

.... When examining the exposure of children, the calculations demonstrate that a mobile phone held against the ear causes an exposure on the brain surface double of that for adults. The difference is

due to children's thinner skull bone and more elastic earlobe. The exposure is however focused to such a small area that the warming-up of children's brain tissue is not any heavier than with adults.

"Children's mobile phone use should be limited", **Januar 2009**

[http://www.stuk.fi/stuk/tiedotteet/en\\_GB/news\\_527/](http://www.stuk.fi/stuk/tiedotteet/en_GB/news_527/)

Finnish Radiation and Nuclear Safety Authority (STUK) has prepared a position paper, according to which children's mobile phone use should be restricted for example by favouring text messages instead of talking. Although research to date, has not demonstrated health effects from mobile phone's radiation, precaution is recommended for children as all of the effects are not known.

"With children, we have reason to be especially careful, because there is not enough research on children's mobile phone use. Unfortunately, it will not be easy to obtain this information in the future, either, because of ethical considerations, the use of children as research subjects must always be heavily justified", according to STUK research director Sisko Salomaa.

- **CCARS (Comité científico asesor en radiofrecuencias y salud)**

"Report on Radiofrequency and Health (2007 – 2008)", **Januar 2009**

[http://www.mobilemastinfo.com/information/radiowaves\\_and\\_health/CCARS%20Report%20on%20Radiofrequency%20and%20Health%202007-2008.pdf](http://www.mobilemastinfo.com/information/radiowaves_and_health/CCARS%20Report%20on%20Radiofrequency%20and%20Health%202007-2008.pdf) (englisch)

<http://www.ccars.es/docs/informes/INFORME%20CCARS%202007-2008.pdf> (spanisch)

*Die spanische unabhängige Experten-Gruppe "Comité científico asesor en radiofrecuencias y salud" (CCARS) hat im Januar 2009 einen Bericht zu dem Thema „Hochfrequente Felder und Gesundheit“ veröffentlicht.*

...it is recommended that parents encourage their young children to use the mobile phone in moderation, until epidemiological studies on this sector of the population become available. In any case, mobiles used by children should always have the speakerphone feature activated. ...

*Priorities for future research:* ... Ascertain whether children or people suffering from certain neurological diseases are particularly sensitive. ...

*Conclusions:* ... With regard to longer exposure periods in adults or the situation of the child population, there is not sufficient data available and rational use of this tool is to be recommended. ...

- **BfS (Bundesamt für Strahlenschutz)**

Stellungnahme des BfS zu dem Artikel: „Pränatale und postnatale Exposition bei Mobiltelefon-Nutzung und Verhaltens-Probleme bei Kindern“ von Divan HA, Kheifets L, Obel C, Olsen J; Prenatal and Postnatal Exposure to Cell Phone Use and Behavioral Problems in Children, *Epidemiology* 2008; Vol 19, no. 4. (2008)

[http://www.bfs.de/de/elektro/hff/papiere.html/Expos\\_Mobiltelef.html](http://www.bfs.de/de/elektro/hff/papiere.html/Expos_Mobiltelef.html)

*Bewertung*

Die vorliegende Studie zeigt ein erhöhtes Risiko für Verhaltensstörungen bei Kindern, die selbst das Handy nutzten, deren Mütter während der Schwangerschaft mit dem Handy telefonierten oder bei denen beides zutraf<!--[if !supportAnnotations]-->. Inwieweit es sich hier um einen kausalen Zusammenhang zwischen Strahlenbelastung und Verhaltensstörungen handelt, kann durch eine einzige Studie nicht beantwortet werden. Die Autoren schlussfolgern selbst, dass die Ergebnisse mit großer Vorsicht interpretiert werden sollten. Die beobachteten Zusammenhänge sind nicht notwendigerweise kausal und können auf anderen, in dieser Studie nicht untersuchten Faktoren beruhen. So unterschied sich die höchste Expositionsgruppe von den anderen Expositionsgruppen in

manchen Faktoren, die diskutiert werden im Zusammenhang mit einem erhöhten Risiko für Verhaltensstörungen bei den Nachkommen (geringerer Sozialstatus, häufiger mentale Störungen, Neurosen, psychiatrische Erkrankungen etc.). Auch wenn dafür adjustiert wurde, ist nicht auszuschließen, dass ein residuales Confounding verbleibt, d. h. ein verzerrter Risikoschätzer auftritt wegen ungenügender Berücksichtigung dieser potentiellen Störgrößen. Andere potentielle Confounder wie psychiatrische Erkrankungen des Vaters oder eine frühere Bleibelastung (z.B. aus dem Trinkwasser) wurden gar nicht erfasst.

Grundsätzlich bleibt unklar, ob Verhaltensauffälligkeiten des Kindes mit der Strahlenbelastung während des Telefonierens oder einfach mit der Nutzung des Telefons durch die Mutter zusammenhängen. So könnte sich zum Beispiel eine Mutter, die viel telefoniert, insgesamt weniger um ihr Kind kümmern.

Es gibt derzeit keine belastbaren Rechenmodelle zur Abschätzung der spezifischen Absorptionsrate (SAR-Wert) – ein Maß für die Strahlenexposition – im Fötus durch Handynutzung der Mutter. Grundsätzlich ist jedoch davon auszugehen, dass tiefer liegende Organe wie der Uterus wahrscheinlich sehr gering exponiert sind. Auch die direkte Strahlenexposition der Kinder während des eigenen Telefonierens dürfte gering sein, da die Kinder der Kohorte das Handy relativ selten und nur über einen kurzen Zeitraum nutzen.

#### *Fazit*

Die Studie zeigt ein erhöhtes Risiko für Verhaltensstörungen bei Kindern, die selbst das Handy nutzten, deren Mütter während der Schwangerschaft mit dem Handy telefonierten oder bei denen beides zutraf. Daraus lassen sich keine abschließenden Schlüsse ziehen, ob die Strahlenbelastung als Ursache hierfür zu sehen ist. Eine mögliche Erklärung für die beobachtete Risikoerhöhung könnte Confounding durch nicht berücksichtigte andere Faktoren, Fehlklassifikation von Erkrankung oder Handynutzung sein. Gegen einen Ursache-Wirkungs-Zusammenhang spricht die extrem geringe pränatale Strahlenexposition und die Tatsache, dass es bisher keinen bekannten biologischen Wirkmechanismus gibt, der hierfür eine Erklärung geben könnte.

Bisher wurden kaum Studien zum Gesundheitsrisiko durch Mobilfunk an Kindern durchgeführt. Eine kürzlich abgeschlossene Querschnittsstudie zu Befindlichkeitsstörungen durch Mobilfunk bei Kindern und Jugendlichen des Deutschen Mobilfunkforschungsprogramms erbrachte keine Hinweise auf vermehrte Befindlichkeitsstörungen durch Mobilfunk. Bezüglich einiger weniger Fragen zu Verhaltensauffälligkeiten wurden ebenfalls keine signifikant erhöhten Risiken gefunden. Da Kinder durchaus empfindlicher als Erwachsene sein könnten und Kinder von Jugend an die neue Technologie verwenden, sind weitere Studien auf diesem Gebiet zwingend nötig.

„Handys für Kinder sind nicht sinnvoll“, **Oktober 2008**

[http://www.bfs.de/de/elektro/hff/papiere.html/bfs\\_handy\\_kind.html](http://www.bfs.de/de/elektro/hff/papiere.html/bfs_handy_kind.html)

Das BfS ist der Auffassung, dass es weiterhin offene Fragen in der wissenschaftlichen Literatur über ein Risikopotential für Kinder sowie Jugendliche und bei Langzeitnutzung gibt, dessen Existenz bisher nicht ausreichend sicher bejaht oder verneint werden kann. Diese Situation berücksichtigend setzt sich das BfS in Übereinstimmung mit nationalen und einigen internationalen Strahlenschutzgremien für Expositionsminimierung bei Kindern und Jugendlichen ein. Dies ist umso wichtiger, als auch in Zukunft eine Zunahme neuer Technologien im Hochfrequenzbereich zu erwarten ist und sich die Expositionen durch relativ einfache Verhaltensmaßnahmen deutlich verringern lassen. Es wird daher vom BfS wie auch von der Strahlenschutzkommission (SSK) als ein Gebot der vorausschauenden Technologieplanung und gesundheitlichen Vorsorge angesehen, alle Möglichkeiten zur Minimierung der Gesamtexposition zu realisieren.

In Bezug auf Kinder ist außerdem festzuhalten, dass bisher nur wenige wissenschaftliche Untersuchungen zu einer möglicherweise erhöhten Empfindlichkeit des Organismus von Kindern und Jugendlichen gegenüber elektromagnetischen Feldern vorliegen. Das BfS rät daher im Sinne der Vorsorge zu einem verantwortungsvollen Umgang mit der Mobilfunktechnik. Zur individuellen Expositionsminimierung gehört, u. a. in Situationen, in denen genauso gut mit einem Festnetztelefon wie mit einem Handy telefoniert werden kann, das Festnetztelefon zu nutzen, Handys mit einem

niedrigen SAR-Wert ( $< 0.6 \text{ W/kg}$ ) zu verwenden, bei schlechtem Empfang möglichst kurz, am besten aber gar nicht mit dem Handy zu telefonieren, Head-Sets zu benutzen oder eine SMS zu verschicken statt zu telefonieren.

„Kinder zu schützen“ wird von Seiten des BfS als wesentlich bedeutsamer erachtet als die „Vergabe eines Blauen Engels“. Das BfS spricht sich deshalb weiterhin gegen die Vermarktung von Kinderhandys aus, selbst wenn diese durch den Blauen Engel gekennzeichnet sind.

- **BUND (Bund für Umwelt und Naturschutz)**

„Für zukunftsfähige Funktechnologien“, **Oktober 2008**

[http://www.bund.net/fileadmin/bundnet/publikationen/sonstiges/20081028\\_sonstiges\\_funktechnologien\\_position.pdf](http://www.bund.net/fileadmin/bundnet/publikationen/sonstiges/20081028_sonstiges_funktechnologien_position.pdf)

....  
Die bereits vorliegenden Erkenntnisse, Erfahrungen und Beobachtungen zeigen unmissverständlich, dass dringend eine drastische Reduzierung bzw. Minimierung der anthropogen verursachten elektromagnetischen Felder erreicht bzw. wirksame Schutz- und Vorsorgemaßnahmen für das Wohl von Menschen, Tieren und Pflanzen ergriffen werden müssen. Die bereits eingeleiteten Entwicklungen zum Ausbau weiterer Funknetze und Funktechnologien geben Anlass zu größter Sorge, da zukünftig noch intensiver auf die biologische Regulation von Lebewesen eingewirkt werden wird. Eine Wende in der Kommunikationstechnik ist daher dringend erforderlich und wird mit dieser Position skizziert.

....  
So muss man gegenwärtig davon ausgehen, dass nicht nur Risikogruppen wie Kleinkinder, sensible Personen, Kranke und Multimorbide (vielfach Erkrankte) durch die zunehmende EMF-Belastung in Mitleidenschaft gezogen werden, sondern dass mit einer allgemeinen Zunahme von Symptomen („Elektrosensibilität“) in der Bevölkerung gerechnet werden muss.

....  
Die Umsetzung dieses BUND-Schutz- und Vorsorgekonzepts bedeutet allerdings eine weitgehende Abkehr von herkömmlichen und geplanten Anwendungen und Übertragungstechnologien hin zu zukunftsfähigen, gesundheitlich unbedenklicheren Kommunikationstechniken und Verhaltensweisen.

....

„Elektrosmog“,

2001 [http://www.bund.net/fileadmin/bundnet/publikationen/sonstiges/20010700\\_sonstiges\\_elektrosmog\\_position.pdf](http://www.bund.net/fileadmin/bundnet/publikationen/sonstiges/20010700_sonstiges_elektrosmog_position.pdf)

....

Darüber hinaus kann es durch EMF zur Beeinflussung elektronischer Implantate kommen, z. B. bei Herzschrittmachern, Insulinpumpen, Hörgeräten, Impulsgebern für Parkinsonerkrankte usw.. Hier entsteht ein anderes Gefahrenpotential, denn die betroffenen Personen (z. B. Kranke, Kleinkinder) können in ihrer vollen Verständnisfähigkeit und Handlungsfähigkeit eingeschränkt sein, um eine Beeinflussungen ihrer Implantate zu erkennen. Sie können ihr Verhalten nicht auf diese Situation einstellen. Ein Beispiel: Kinder erhalten aus dringenden gesundheitlichen Gründen bei schweren Hörschäden zunehmend elektronische Implantate. Zusätzlich sollen die Lern- und Erlebnismöglichkeiten erweitert werden. Die betroffenen Kinder sind aber (z. B. aufgrund ihres Alters oder wegen spezieller gesundheitlicher Einschränkungen) nicht in der Lage, auftretende Störungen zu erkennen oder zu beschreiben. ....

Forderungen des BUND zum Schutz und zur Vorsorge vor EMF im Umwelt- und Gesundheitsschutz: Der Gesetzgeber hat mit der 26. BImSchV von 1996 den fachgesetzlich verankerten Schutzanspruch zur Verhinderung schädlicher Umwelteinwirkungen geregelt. Die dort festgelegten, auch international üblichen Grenzwerte können aber lediglich die Bekämpfung kritischer Temperaturerhöhungen und Reizwirkungen von Feldern bezwecken. Damit werden Menschen auf einen lediglich physikalisch beschreibbaren und somit quasi technischen Gegenstand reduziert. Die dort fest gelegten Werte können nicht vor den oben angesprochenen nicht-thermischen Effekten schützen, was heute eigentlich niemand mehr bestreitet 9.

Auch die in der 26. BImSchV verankerte Vorsorge ist völlig unzureichend, da sie im Gegensatz zur Vorgabe der Grenzwertempfehlung durch die ICNIRP 10 lediglich im Bereich der Niederfrequenz von 50 Hertz zusätzliche Grenzwertüberschreitungen ausschließt. Die Konkretisierung des Vorsorgeprinzips in Form eines Grenz- oder Zielwertes ist nicht erfolgt. Da eine wirksame Begrenzung der Immissionen von nieder- und hochfrequenten Feldern ohne Vergleichswerte aber kaum möglich ist, hat der BUND vorläufige Immissionswerte als Forderung aufgestellt und unten näher begründet (s. Tabelle 6–4 und Tabelle 6–5 nebst Erläuterungen). Nach dieser Forderung müssten die Werte der 26. BImSchV zumindest um den Faktor 100 (in der Angabe nach ICNIRP Faktor 10.000) unterschritten werden. Die daraus resultierenden Feldstärken liegen allerdings immer noch im Bereich von beobachteten Wirkungen, so dass die angegebenen Werte lediglich als eine Mindestforderung zu verstehen sind.

- **SSK (Strahlenschutzkommission)**

German Mobile Telecommunication Research Programme (DMF) – Statement by the German Commission on Radiological Protection, **Mai 2008**  
<http://www.ssk.de/werke/volltext/2008/ssk0804e.pdf>

....

#### *2.7.2. Age-dependent effects, especially in children*

“Studies B215 and B22 looked at particular sensitivities in children. In the laboratory study B22, experimental animals were exposed continuously to UMTS fields over several generations (thus including their foetal stage). Even under life-long exposure there was no evidence of negative effects on reproduction or on embryonic and infant development. This study was therefore unable to confirm that particular sensitivities exists in the early years of life. This is particularly important in regard to the discussion of possible particular sensitivity in children.

In a feasibility study (B2) the literature review showed that the question of a possible age-dependent effect of high-frequency fields and particular vulnerability in children is still open.

The study concludes that dosimetry projects should be given priority, although biological and epidemiological studies are also regarded as feasible. The study, which was completed in 2004, was an important aid in setting future priorities of the DMF. Since then some new dosimetric studies have been published (Christ and Kuster 2005, Conil et al. 2008); mention must also be made of the SSK report on mobile phones and children (“Mobilfunk und Kinder”, SSK 2006).“

... Studies on lifelong exposure have found no indications of impacts upon foetal or infant development. Better assessment of potential special sensitivities in children still requires further research and the closing of knowledge gaps that were identified. This calls for improved anatomic models of children of various age groups and age-specific tissue parameters. ...

...Unresolved issues also remain with regard to the exposure of foetuses and children, and with respect to potential effects upon cognition, feelings of ill-health and sleep. ...

... For the purposes of exposure assessment by numerical simulation, there is a need to develop anatomical models for pregnant women in different stages of pregnancy and for children (and their heads) of different ages as well as high-resolution models for higher frequencies.

„Mobilfunk und Kinder“ Stellungnahme der Strahlenschutzkommission, **Dezember 2006**  
<http://www.ssk.de/werke/volltext/2006/ssk0619.pdf>

#### *Schlussfolgerungen und Empfehlungen:*

.....

Die SSK stellt fest, dass erst wenige Studien über potentielle gesundheitliche Auswirkungen des Mobilfunks auf Kinder und Jugendliche vorliegen und die gegenwärtige Datenlage keine wissenschaftlich fundierten Aussagen über mögliche altersspezifische Gesundheitsgefährdungen erlaubt. Aus dem Fehlen von belastbaren Untersuchungen kann weder auf ein erhöhtes noch auf ein vermindertes Risiko geschlossen werden.

....

Auch wenn nach derzeitigem wissenschaftlichem Kenntnisstand keine höhere Empfindlichkeit von Kindern und Jugendlichen gegenüber Hochfrequenzfeldern festgestellt werden kann, hält es die SSK u.a. wegen der längeren Lebenszeitexposition für diese Personengruppe und dem in Zukunft zu erwartenden Anstieg der Mobilfunkanwendungen für ratsam, Empfehlungen zur Verringerung der Exposition zu beachten. Hierzu spricht die SSK in der Stellungnahme eine Reihe von Empfehlungen aus.

....

Die SSK hebt hervor, dass diese Stellungnahme nicht als Befürwortung einer verstärkten Mobilfunknutzung durch Kinder und Jugendliche ausgelegt oder als Werbeargument verwendet werden kann.

....

- **Arpansa (Australian Radiation Protection and Nuclear Safety Agency)**

„Mobile phones and children“, April 2008

<http://www.arpansa.gov.au/pubs/eme/fact11.pdf>

....

*The science*

There has been limited scientific research on the issue of mobile phone use by children. The definition of a child varies although the 3 to 14 year age range is often used.

In this context questions have been posed and research will be required to answer whether the exposure dose received by a child's brain is higher than that received by an adult, children are more sensitive due to their developing nervous system and children are more vulnerable due to a longer lifetime exposure.

*Energy absorption* - It has been suggested that children may experience greater absorption of energy in the tissues of the head when using a mobile phone. Studies have been conducted to measure the energy absorption from a mobile phone using anatomically correct phantoms of both child and adult heads. However, there is insufficient evidence to substantiate this hypothesis. For mobile phone handsets, the limits of the ARPANSA Radiation Protection Standard "Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz" are applicable to all individuals of different sizes and tissue properties, including children.

....

*Base stations* - Public concern has also been expressed regarding the possibility of adverse health effects from mobile phone base stations that are sited on or near places where children spend large amounts of time, for example, in or outside their home, kindergardens, schools, playgrounds etc. The balance of evidence does not indicate a risk to the health of people, including children, living in the vicinity of base stations where the exposure levels are only small fractions of the ARPANSA Standard.

....

*Recommendations*

Community concern has been expressed with regard to mobile telephone use by children. At present, there is insufficient evidence in the science to substantiate the hypothesis that children maybe more vulnerable to RF EME emissions from mobile phones than adults.

It's recognised that parents provide mobile phones to their children for different reasons, including their child's personal security as well as the assurance of their child being constantly contactable.

It is recommended that if individuals are concerned, they should choose to limit their own or their children's RF EME exposure by limiting the number and length of calls, or using "hands-free" devices to keep mobile phones away from the head and body. Users should pay attention to manufacturers' advice regarding spacing from the body if phones are to be attached to belts or placed in pockets.

- **SSI (Swedish Radiation Protection Institute)**

[http://www.who.int/peh-emf/publications/reports/SWEDENssi\\_rapp\\_2007.pdf](http://www.who.int/peh-emf/publications/reports/SWEDENssi_rapp_2007.pdf)

*Executive summary*

*RF (radiofrequency) fields*

.....

An important dosimetry finding is that in the GHz range (mobile telephony) the whole body SAR is higher than previously thought when short subjects or children are exposed to far field waves as compared to tall subjects or adults. These data have been published by one group, and we await publications from other groups as well.

#### *Dosimetry*

Specific absorption rate (SAR) is determined under various exposure conditions using numerical models. Recent research has indicated that whole body SAR values are influenced by the size of the exposed person. The main finding is that in the GHz range (mobile telephony) the whole body SAR is substantially higher than the basic restriction when short subjects or children are exposed to far field waves at the reference level (e.g. 4.5 W/m<sup>2</sup> at 900 MHz). So far only a Japanese group [Hirata, et al. 2007; Wang, et al. 2006a] has published these data. Other groups have confirmed these findings and have reported results at conferences, but have not yet published their data. These findings cannot be taken for granted until these further studies have been published. Similar data for exposure of the foetus are not yet available.

#### *Update on key issues*

c) Studies of cancer risk in mobile phone users have been discussed in all reports. Short-term use of mobile phones does not appear to be associated with brain or head and neck cancer risks in adults. However, other outcomes have not been studied, no studies on children or adolescents have been done, and long-term use has not been fully evaluated. In particular for acoustic neuroma there is a concern about long-term mobile phone use.

- **BAFU (Bundesamt für Umwelt, Schweiz)**

„Hochfrequente Strahlung und Gesundheit - Bewertung von wissenschaftlichen Studien im Niedrigdosisbereich. 2. aktualisierte Auflage“, 2007

<http://www.bafu.admin.ch/publikationen/publikation/00059/index.html?lang=de>

#### *Leukämien, maligne Lymphome:*

Im Umfeld von drei TV- und Radiosendern in Australien hatten Hocking et al. 1996 bei Erwachsenen und Kindern erhöhte Leukämie-Erkrankungsraten festgestellt. In der Folgepublikation verglichen die Autoren jetzt die Überlebenszeit leukämiekranker Kinder aus dem inneren Ring um die drei Sendetürme herum (bis 4 km) und aus dem angrenzenden Gebiet (Hocking et al. 2003). Die Fünf-Jahres-Überlebensrate betrug in der Nähe der Sender 49 %, im Vergleichsgebiet 62 %. Die Zehn-Jahres-Überlebensrate lag im Sendergebiet bei 33 %, im Vergleichsgebiet bei 55 %. Daraus ergab sich in der für Alter, Geschlecht und Diagnosejahr korrigierten Analyse ein gerade noch signifikantes Sterblichkeitsratenverhältnis von 1.8 (95 %-CI: 1.0–3.0) zwischen Sender- und Kontrollgebiet. Die Autoren weisen auf die Möglichkeit einer krebsbegünstigenden Wirkung der TV-Senderstrahlung hin, da der Sterblichkeitsunterschied bei längerer Beobachtungsdauer zunahm.

.....

Auf Grund der bis 2002 publizierten Studien wurde als möglich bewertet, dass das Risiko für Tumore des blutbildenden und lymphatischen Systems in der Umgebung von stark sendenden Rundfunksendern erhöht ist. Die aktuelle Auswertung von Hocking et al. 2003 evaluiert nicht das Leukämierisiko selbst, sondern die Überlebenszeit leukämiekranker Kinder in verschiedenen Expositionszonen um Rundfunksender herum. Sie betrifft mögliche Wirkungsmechanismen der Hochfrequenzexposition, kann aber nicht als neuer Hinweis auf einen Zusammenhang zwischen Exposition und Erkrankungsrisiko gewertet werden. Die Studie von Park et al. 2004 beobachtete erhöhte Leukämierisiken bei Kindern und jüngeren Erwachsenen in der Nähe von Radiosendern, liefert aber keine Angaben zur Feldstärke im als exponiert definierten Gebiet und konnte keine individuellen Faktoren einbeziehen. Die Risikoschätzer für die gesamte Krebssterblichkeit waren nicht mit der Sendeleistung der Radiosender (in kW) assoziiert. Bezüglich des Leukämierisikos liess sich diese Analyse nicht durchführen, weil die Anzahl der Leukämiepatienten zu gering war. Neben der Problematik der rein geografischen Expositionsabschätzung ist insbesondere unklar, wie lange die Leukämiepatienten bereits in dem jeweiligen Gebiet wohnten. Das Resultat deutet aber darauf hin,

dass die Leukämie- und Lymphomraten um stark sendende Rundfunksender erhöht sind. Die beobachteten Zusammenhänge sollten zum Beispiel in Fall-Kontrollstudien weiter abgeklärt werden.

.....

#### *Kognition:*

Auch in den beiden Studien an Kindern zeigten sich keine signifikanten Unterschiede bezüglich Reaktionszeiten und Fehlerraten im Zusammenhang mit der Exposition (Haarala et al. 2005, Preece et al. 2005). ...

.....

#### *Fertilität und Auswirkungen auf die Nachkommen:*

Im Zusammenhang mit einer möglichen *zellschädigenden Wirkung* von Hochfrequenzstrahlung wurden auch Risiken für die Nachkommen von exponierten Personen und Einflüsse auf die Fruchtbarkeit diskutiert. Die in UM 162 erfassten Studien untersuchten das Risiko für Fehl- oder Frühgeburten, angeborene Missbildungen und Tumorerkrankungen bei Kindern. Zusätzlich wurden Auswirkungen der hochfrequenten Strahlung auf die Spermienqualität von beruflich exponierten Männern untersucht. Die meisten Untersuchungen betrafen Personen, die mit Kurzwellendiathermiegeräten gearbeitet hatten. Ihre Resultate sind nicht konsistent. Nach der Benutzung von Mobiltelefonen wurde nur in einer Studie an Eltern von Kindern mit einem Nervenzelltumor gefragt, und lediglich sieben Mütter gaben an, regelmässig ein Mobiltelefon zu verwenden (De Roos et al. 2001). Zu diesem Thema liegen keine neuen Publikationen vor. Seit dem Bericht UM 162 sind zwei Arbeiten erschienen, die Zusammenhänge zwischen dem Mobiltelefongebrauch und der männlichen Fertilität untersucht haben.

.....

Sowohl die beiden Studien zur *Spermienqualität* bei Mobiltelefonbenutzern als auch die experimentelle Studie mit In-vitro-Exposition kamen im Wesentlichen zum selben Ergebnis: Es ergab sich eine Abnahme der Spermienbeweglichkeit nach hochfrequenter Exposition, aber keine Änderung der Spermienkonzentration. Leider haben beide Studien mit In-vivo-Belastung erhebliche methodische Schwächen. Jede einzelne dieser Arbeiten muss als nicht aussagekräftig beurteilt werden. Die Belastungssituationen der drei Studien können nicht verglichen werden. Die übereinstimmenden Resultate könnten Ergebnis eines typischen Publikationsbias sein, bei dem ohne Peer-Review-Verfahren und in sekundären Zeitschriften selektiv das veröffentlicht wird, was bereits beobachtet wurde. Die Studien werden hier trotzdem angeführt, weil sonst keine Ergebnisse aus den letzten Jahren zu diesem Thema vorliegen. Wissenschaftlich gut abgestützte Resultate aus erstklassigen Publikationen sind hier dringend zu wünschen.

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- **Bioinitiative-Report, USA**

"Bioinitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF)", **August 2007**

<http://www.bioinitiative.org/report/docs/report.pdf>

#### *Evidence for childhood cancers:*

.....

The balance of evidence suggests that childhood leukemia is associated with exposure to power frequency EMFs either during early life or pregnancy.

- Considering only average MF flux densities the population attributable risk is low to moderate, however, there is a possibility that other exposure metrics are much stronger related to childhood leukemia and may account for a substantial proportion of cases. The population attributable fraction ranges between 1-4% (Kheifets et al., 2007) 2-4% (Greenland & Kheifets 2006), and 3.3% (Greenland 2001) assuming only exposures above 3 to 4 mG are relevant. However, if not average MF flux density is the metric causally related to childhood leukemia the attributable fraction can be much higher. Up to 80% of childhood leukemia may be caused by exposure to power frequency EMF.
- Other childhood cancers except leukemia have not been studied in sufficient detail to allow conclusions about the existence and magnitude of the risk. 14 IEEE guideline levels are designed to protect from short-term immediate effects, longterm effects such as cancer are evoked by levels several orders of magnitudes below current guideline levels.
- Precautionary measures are warranted that should reduce all aspects of exposure, because at present we have no clear understanding of the etiologically relevant aspect of the

exposure.

*Key Scientific Evidence and Public Health Policy Recommendations:*

....

Restrictions should be placed on the sale and advertising of cell phones and other wireless devices to children age 0 to 18 years.

...

Health agencies and school districts should strongly discourage or prohibit cell towers on or near (within 1000' of) school properties, should delay any new WLAN installations in school classrooms, pre-schools and day-care facilities; and should either remove or disable existing wireless facilities, or be required to offer classrooms with no RF exposure to those families who choose not to have their children involuntarily exposed.

....

- **IZMF (Informationszentrum für Mobilfunk)**

"Mobilfunk und Kinder" 4. Stakeholder Workshop des Kommunikationsforums Mobilfunk, **Oktober 2007**

<http://www.izmf.de/download/archiv/Kommunikationsforum2007.pdf>

„...dass die bisher vorliegenden Studien nicht auf eine besondere Empfindlichkeit von Kindern und Jugendlichen hindeuten. Schon ab dem fünften Lebensjahr weisen Kinder keine grundlegenden physiologischen Unterschiede mehr zu Erwachsenen auf, so dass ab diesem Kindesalter für die Risikobetrachtung die gleichen Maßstäbe anzulegen sind wie für Erwachsene. Interpersonelle Unterschiede sind größer als Unterschiede zwischen Kindern und Erwachsenen. Noch zu erforschen sind Wirkungen, resultierend aus der längeren Lebenszeitexposition und dem allgemeinen Anstieg von Funkanwendungen im Umfeld der Kinder.“

"Mobilfunk und Gesundheit" Eine Broschüre für Eltern, **Oktober 2009**

[http://www.izmf.de/download/archiv/IZMF\\_KU\\_Elternbrosch\\_RZ\\_web2\\_090928.pdf](http://www.izmf.de/download/archiv/IZMF_KU_Elternbrosch_RZ_web2_090928.pdf)

„Weiterer Klärungsbedarf wird im Bereich der Langzeitwirkung bei der Nutzung von Mobilfunkgeräten und möglichen Auswirkungen des Mobilfunks auf Kinder gesehen. Durch weitere Forschungsaktivitäten will die Bundesregierung in den nächsten Jahren diesen Fragen nachgehen.“

„Dürfen auch Kinder mit dem Handy telefonieren?“, **200?**

<http://www.izmf.de/html/de/34087.html>

„Ja. Handelsübliche Mobiltelefone entsprechen den Sicherheitsempfehlungen der Internationalen Kommission zum Schutz vor nichtionisierenden Strahlen (ICNIRP), welche u.a. von der Weltgesundheitsorganisation (WHO) und der Strahlenschutzkommission (SSK) übernommen wurden. Diese Richtlinien berücksichtigen auch die besonderen Bedingungen für Kinder sowie ältere und kranke Mitbürger.“

- **MTHR (Mobile Telecommunications and Health Research Programme), UK**

Report **2007**

[http://www.mthr.org.uk/documents/MTHR\\_report\\_2007.pdf](http://www.mthr.org.uk/documents/MTHR_report_2007.pdf)

....

*Executive summary - Research recommendations*

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Another gap concerns the effect of RF exposure on children. The reactions of children to environmental agents, such as lead, tobacco smoke, ultraviolet radiation, and ionizing radiation, may be different and/or stronger than those of adults. It is therefore possible that the same could be true of exposure

to mobile communications signals and very little has been done so far to investigate whether this is the case.

These two issues – a cohort study on adults and research on children – are the main priorities for the recently announced extension to the Programme, MTHR2, for which funds of around 6 Million Pounds have already been committed.

#### *Brain function - Future research needs*

...

Finally, the STEWART Committee particularly mentioned possible effects of mobile phone signals on children. Current results do not suggest that brain function in children is particularly sensitive to mobile phone signals (Haarala 2005, Preece 2005) but this area remains relatively under-researched.

#### *Research recommendations*

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Research recommendations: epidemiological studies to look for associations between RF exposure and childhood diseases.

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There is currently relatively little information available on whether exposure to signals emitted by mobile phones can cause symptoms such as headaches, migraine, dizziness, anxiety, loss of concentration, or sleeplessness. The Committee is aware of work underway in this area in Germany, but considers that there would be merit in supporting additional work in the UK.

The Committee will give consideration to supporting proposals to set up a cohort study to examine whether there is any association between Childhood illness (Headache, migraine, dizziness, anxiety, etc.) and exposure to mobile phone emission.

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- **Department of Communications, Marine and Natural Resources, Ireland**

"Health effects of electromagnetic fields", 2007

<http://www.dcenr.gov.ie/NR/rdonlyres/9E29937F-1A27-4A16-A8C3-F403A623300C/0/ElectromagneticReport.pdf>

#### *Mobile phone use by children:*

There are no data available to suggest that the use of mobile phones by children is a health hazard. However, in Sweden and the UK, the authorities recommend a precautionary approach to either minimise use (essential calls only) or minimise exposure (by using a hands-free kit). In the Netherlands the use of mobile phones by children is not considered a problem. No research has found any adverse health effects from children using mobile phones, but more research on this issue has been recommended by WHO.

#### *Chapter 3: Frequently asked questions*

##### *Are children and the elderly more sensitive to EMF?*

Currently there is no scientific evidence that children, diseased adults or the elderly are any more sensitive to EMF exposure than healthy adults. However, the ICNIRP international guidelines have included an additional safety factor of 5 into their exposure limits to take account of this possibility. At a recent WHO workshop convened to determine whether children were more sensitive than adults, it was concluded that they do not appear to be more sensitive than adults after about 2 years of age, and that the current ICNIRP guidelines seem to provide sufficient protection for children from EMF exposure.

##### *Is it safe for children to use mobile phones and should phone masts be located near places where children gather?*

There is no data available to suggest that the use of mobile phones by children is a health hazard. The time in children's development that might make them particularly vulnerable to RF exposures to the head is when they are aged two years and younger. In the UK and Sweden the authorities recommend a precautionary approach to either minimise use (essential calls only) or minimise exposure (use a hands-free kit). In the Netherlands the use of mobile phones by children is not considered a problem. There is no established scientific basis or evidence of adverse health effects

affecting children or adults as a result of their exposure to mobile phone base stations. This applies irrespective of the location of the phone mast.

#### *Children and mobile phones - conclusions*

Recent expert analysis has concluded that there are no major effects due to focussing of the RF field in the head or to other properties of a child's head that might result in higher absorption of RF energy (*Christ and Kuster, 2005; Keshvari and Lang, 2005*).

Even though children are using mobile phones at a younger and younger age there are few users under the school age of five. Children tend to use their phones for sending texts rather than voice calls; this reduces their exposure. The use of hands-free kits also reduces exposures but these are not popular among children.

Three expert groups have reviewed the question of whether there should be restrictions on children using mobile phones.

Two have recommended that there should be some restrictions, while one has suggested that it would make no difference. Given this disagreement it seems prudent to suggest that mobile phone use should be limited in younger children. However, there is no specific scientific justification for this advice.

#### *Children and base stations – conclusions*

There is no scientific basis for, or evidence of, adverse health effects affecting either children or adults as a result of their exposure to RF fields from phone masts. This applies irrespective of the location of the phone mast. While

the maximum exposures from a phone mast will occur at some distance from the mast, and not in its immediate vicinity nor underneath it, the exposures are so low as to make it immaterial where masts are located with respect to schools, playgrounds, health centres or other places where children gather. The foregoing statements are not in accord with the positions adopted by some members of the public over what are suitable and unsuitable places to locate phone masts. The public can have legitimate concerns over the physical appearance of such masts in their neighbourhood. It is also true that some will be worried about the possible effects the mast may have on the health of their family, but the scientific evidence does not support their concerns.

#### *Children and RF fields - Overall conclusion*

In the case of RF fields the scientific evidence does not suggest that children are more susceptible than adults to such exposure.

However, without further research, the absence of an observed effect does not rule out the possibility that RF exposure might have some latent adverse health effect. Much of this necessary research is now underway, in coordinated studies across Europe and elsewhere, and more is planned. The results of this work will help answer many of the outstanding questions on the health effects of children's exposure to RF fields.

#### *EMF research in Ireland*

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The following are some research topics the Expert Group considers to be feasible and needed in Ireland:

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A pilot study on the use of mobile telephones by children to determine patterns of use (texting, messaging, calling) and the associated EMF exposures.

- **AFSSET (Agence Française de Sécurité Sanitaire de l'Environnement et du Travail), Frankreich**

"Téléphonie mobile & santé", April 2005

[http://www.afsset.fr/upload/bibliotheque/184632204692143805342647948037/telephonie\\_mobile\\_2005.pdf](http://www.afsset.fr/upload/bibliotheque/184632204692143805342647948037/telephonie_mobile_2005.pdf)

- **WHO (World Health Organization)**

„Children's EMF Research Agenda“, 2004

<http://www.who.int/peh-emf/research/children/en/index.html>

*The Dosimetry Working Group made the following general recommendations:*

- A better understanding of foetal and childhood exposure to EMFs is required, including an assessment of exposure to the high static magnetic fields encountered around magnetic resonance imaging (MRI) equipment and the lower static magnetic fields encountered in public transport vehicles, and an assessment of exposure to ELF fields, especially residential exposure from under-floor electrical heating and from transformers in apartment buildings. For RF fields, exposure assessment is particularly weak for base stations and TV and radio towers and needs further exploration. **High Priority**
- More-accurate dosimetric models of pregnant women, of foetuses at various developmental stages (neural tube closure; differentiation and organogenesis; growth) and of children are needed. In addition, an exploration of EMF microdosimetry at the cellular or subcellular levels should be supported. **High Priority**
- Additional data on the dielectric and thermal properties of human tissues and organs at various developmental stages, including the foetal stage, is needed. **High Priority**

*Radio Frequency Fields*

#### *1. Epidemiological studies*

There is little relevant epidemiology at present that examines health effects in children; the following recommendations address general health effects, including cancers in children who use mobile phones or live near base stations or radio or TV towers.

- Prospective cohort study of children mobile phone users and all health outcomes other than brain cancer (see below) but including more general health outcomes such as cognitive effects and effects on sleep quality. **High Priority**
- Case-control study of children mobile phone users and brain cancer. **High Priority**
- Nested case control studies of childhood cancer with improved exposure assessment for (1) base stations and (2) TV and radio towers. **High Priority**

#### *2. Volunteer studies*

The following recommendations address effects seen in laboratory-based studies using adult volunteers.

- A laboratory-based assessment of effects of RF exposure on cognition, EEGs, and sleep in children is recommended as a part of a larger prospective cohort study (see the Epidemiology section). If ethical approval can be obtained, acute effects on cognition and EEGs should also be investigated in children exposed to RF fields in the laboratory. **High Priority**

#### *3. Animal studies*

A large U.S. National Toxicology Program (NTP) rodent (both rats and mice) study is likely to be funded in the near future. The study will examine the toxicity and carcinogenicity of RF radiation characteristic of mobile phones; animals will be exposed in utero and postnatally. A full histopathology will be carried out, along with assays of endocrine levels, estrus cycling and sperm levels, urinary metabolite patterns (as indicators of physiological perturbation), haematology and genotoxicity (i.e., micronucleus frequency, DNA-strand breaks, etc.). There will be a particular focus on changes in blood-brain-barrier permeability and any concomitant neuropathology. [Tissue may be made available to other research groups; contact Ron Melnick, email: [melnickr@niehs.nih.gov](mailto:melnickr@niehs.nih.gov)]

The recommendations given below focus on the developing central nervous system, haemopoietic (bone marrow) tissue and immune system. Experimental protocols should include prenatal and/or early postnatal exposure to EMFs.

- Studies investigating the effects of prolonged exposure of immature animals to RF fields on the development and maturation of the CNS, using behavioural, morphological (e.g., synapse formation) and molecular (e.g., using gene microarrays) endpoints. **High Priority**
- Effects of prenatal exposure to RF fields on the development and maturation of the blood-brain barrier. [Note that funded work is likely to begin on this topic in the near future; see above.] **High Priority**

- Studies investigating the effects of prolonged exposure of immature animals to RF fields on the development of the immune system, including microglia cells (resident macrophages) and induction of autoimmunity in the brain. **Medium Priority**

#### 4. In vitro studies

Studies of possible RF effects on carcinogenic processes, particularly effects on differentiation pathways and haemopoietic tissue, continue to be of interest. In addition, effects on nerve cell growth and synaptogenesis are considered worthy of further research. The possibility that biological tissue can somehow demodulate modulated RF signals to produce biologically significant ELF electric fields and currents has long been a controversial area. Research into this area, based on a recently proposed, very sensitive method of detection, is being funded in the UK (Challis, in press). If real, this effect could have important implications for both childhood and adult exposure. Other mechanistic studies were also recommended.

- Studies of RF effects on cell differentiation, e.g., during haemopoiesis in bone marrow, and on nerve cell growth using brain slices/cultured neurons. **High Priority**
- Continued studies of possible mechanisms of RF interaction. **Medium Priority**

#### 5. Dosimetry and exposure assessment

A key issue in this area has been the development of a personal dosimeter in order to greatly improve exposure assessment (for example, around base stations) for epidemiological studies (Wiert, in press). Recommendations were made for improved childhood exposure assessment and dosimetric and thermal modelling.

- Research is needed to document rapidly changing patterns of phone use (SMS, email, classical phone communication, etc.) and exposure of different parts of the body for children and foetuses. **High Priority**
- Dosimetric models of RF energy deposition in children and foetuses, combined with appropriate models of human (childhood) thermoregulatory responses, should be developed. **High Priority**

- **NRPB (National Radiological Protection Board, UK), nowadays HPA (Health Protection Agency)**

"Mobile Phones and Health 2004: Report by the Board of NRPB"

[http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb\\_C/1254510624582?p=1219908766891](http://www.hpa.org.uk/webw/HPAweb&HPAwebStandard/HPAweb_C/1254510624582?p=1219908766891)

Since the publication of the Stewart Report in May 2000, a substantial number of reviews into the health effects of mobile phones and health have been produced by national and international committees, expert groups, and agencies. These reports have reviewed the relevant literature, formed conclusions on the likelihood of adverse health effects, and made recommendations for additional research.

The intention of this report is to bring the information from these various sources together and to highlight any commonality or differences in opinion.

#### *Executive summary:*

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16. IEGMP considered that children might be more vulnerable to any effects arising from the use of mobile phones because of their developing nervous system, the greater absorption of energy in the tissues of the head and a longer lifetime of exposure. Data on the impact on children have not yet been forthcoming. The potential for undertaking studies to examine any possible effects on children, however, are limited for ethical reasons.

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58. IEGMP considered that children might be more vulnerable to any effects arising from the use of mobile phones. The potential for undertaking studies to examine any possible effects on children are, however, limited for ethical reasons. It was recommended in the Stewart Report that the use of mobile phones by children should be minimised and this was supported by the Departments of Health. Text messaging has considerable advantages as the phone is in use

for only a short time, when the phone transmits the message, compared with voice communication.

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59. The Board concludes that, in the absence of new scientific evidence, the recommendation in the Stewart Report on limiting the use of mobile phones by children remains appropriate as a precautionary measure.

60. The Board also welcomes an initiative by the World Health Organization in its EMF programme to focus attention on research relevant to the potential sensitivity of children.

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89. The Board particularly supports the need for further research, in the following areas: (a) an international cohort study of mobile phone users aimed at pooling and sharing experimental design, findings and expertise internationally, (b) an expanded programme of research on TETRA signals and biological effects, (c) effects of RF exposure on children, (d) investigation of public concerns about mobile phone technology, (e) electromagnetic hypersensitivity and its possible impact on health, including well-being, associated with mobile phone technology, (f) studies of RF effects on direct and established measures of human brain function and investigations of possible mechanisms involved, (g) complementary dosimetry studies focused on ascertaining the exposure of people to RF fields.

- **HCN (Health Council of the Netherlands)**

Mobile telephones; an evaluation of health effects. **2002**

<http://www.gezondheidsraad.nl/en/publications/mobile-telephones-evaluation-health-effects>

Mobile telecommunication has developed considerably in recent years: to date over half the population of the Netherlands possesses a mobile telephone. Nevertheless, concerns also grow, particularly as to whether exposure to electromagnetic fields from antennas and mobile telephones can adversely affect health. In this advisory report, the Electromagnetic Fields Committee of the Health Council of the Netherlands provides, on the basis of the scientific literature, an overview of various aspects that may play a role. The Committee comes to the conclusion that there is at present no reason for concern. However, since mobile telephony leads to widespread electromagnetic field exposure and relatively little knowledge exists on, especially, longterm effects, it indicates areas for further research. In particular, the Committee indicates in what areas research can be conducted in the Netherlands.

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*Use by children*

It is unlikely from a developmental point of view that major changes in brain sensitivity to electromagnetic fields still occur after the second year of life. The Committee therefore concludes that there is no reason to recommend that mobile telephone use by children should be limited as far as possible.

*Precautionary principle*

The Committee concludes that the scientific information concerning non-thermal effects discussed in this report provides no reason to apply the precautionary principle and lower the SAR limits for partial body exposure.

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Electromagnetic fields: Annual Update 2008

<http://www.gezondheidsraad.nl/en/publications/electromagnetic-fields-annual-update-2008>

<http://www.gezondheidsraad.nl/sites/default/files/200902.pdf>

*Advisory letter on mobile telephony studies 2007:*

In response to a request from the Minister of Housing, Spatial Planning and the Environment, the Committee wrote an advisory letter<sup>7</sup> containing its initial reaction to three scientific publications.<sup>8-10</sup> The Minister asked the Health Council whether the published research results gave grounds for revising earlier conclusions regarding any effects that mobile telephony might have on health.

The Committee's conclusion on the basis of the aforementioned publications, as well as references it had previously discussed, was that the new research results gave no grounds for revising its original standpoints. The Committee maintained its conclusion that no causal link has thus far been demonstrated between health problems and exposure to electromagnetic fields generated by mobile phones or base stations for mobile telephony. However, the Committee believed that further scientific research into any such links was still warranted. In the present Annual Update, the Committee presents a more in-depth discussion of the subjects covered in the articles by Cook<sup>8</sup> and Hutter<sup>10</sup>. A systematic analysis commissioned by the Committee is currently underway of the available epidemiological references in relation to 'mobile phones and brain tumours'. The results of the analysis will be separately published in 2009.

*Radiofrequency electromagnetic fields and brain activity (studies involving human subjects) (mobile phones)*

....

*Effects on ERPs*

These studies primarily investigated the effects of GSM signals on ERPs produced by auditory, visual and sensory stimuli. One research group focused on ERPs in relation to performance of cognitive tasks<sup>56-59</sup>; another group studied effects on the cerebral cortex of exposure to radiofrequency electromagnetic fields by using transcranial magnetic stimulation (stimulation of small sections of the cerebral cortex by a strong magnetic field produced in a coil held against the head) to induce muscle movement.<sup>60</sup> Most studies were conducted with adults; only one study was conducted with children.<sup>61</sup>

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*Cognitive functioning*

A varied picture likewise emerges from studies of cognitive effects, not least because there is little uniformity in the tests used. Some studies found that exposure to mobile phone signals produced effects, but they were always minor, reversible effects and generally indicated a performance improvement.<sup>39,54,90-99</sup> Studies involving larger numbers of human subjects do not generally indicate any effects.<sup>74,100-110</sup> No greater effect was found for children<sup>110-114</sup> and people who consider themselves to be electrosensitive<sup>115-118</sup> than was found for healthy adults. Some years ago, the World Health Organization appealed for more research to be conducted among children.<sup>119</sup> The Health Council adopted this appeal in its recommendations for research in the Netherlands.<sup>120</sup>

....

*Conclusion*

Exposure to radiofrequency electromagnetic fields produced by mobile phones may lead to subtle changes in brain activity. However, the observed effects are temporary and small and, as far as is known, have no effect on health. The picture that emerges from studies of effects on cognitive functioning is unclear: some studies found minor and reversible effects while others found no effect.

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*Radiofrequency electromagnetic fields and symptoms*

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*Conclusion*

The picture that emerges from the available scientific evidence is that there is no causal link between exposure to radiofrequency electromagnetic fields and the occurrence of medically unexplained physical symptoms. However, there is a link between the symptoms and *assumed* exposure and with that very probably a link to risk perception. Nevertheless, the symptoms do exist and require a solution.

- **Australian Mobile Telecommunications Association (AMTA)**

"Children's mobile claims run counter to weight of scientific experts", 200?

<http://www.amta.org.au/articles/amta/Childrens.mobile.claims.run.counter.to.weight.of.scientific.experts.9817>

Today's claims about children and mobile phone safety run counter to the weight of expert scientific findings and parents can be reassured that the World Health Organisation (WHO) says strict science-based safety limits provide ample protection for all users of mobiles, including children.

The Chief Executive Officer of the Australian Mobile Telecommunications Association (AMTA), Chris Althaus, said the industry places the highest importance on safety issues and relies on the expert judgement of bodies such as the WHO to make decisions based on the weight of scientific evidence about the safety of mobile phones and base stations.

AMTA was replying to a British newspaper report in the Independent that claimed new research had found children and teenagers were five times more likely to get brain cancer if they used mobile phones. Mr Althaus said Dr Lennart Hardell's claims about children were alarmist and had not undergone the proper process of review by scientific peers.

"Mobile phone handsets and base stations are designed, built and tested to comply with strict science-based safety standards, which are recognized by national and international health agencies, including the WHO, as providing protection for all members of the community," he said.

"The standards include significant in-built safety margins and provide protection for all users, including the elderly, children and others regardless of the frequency of use.

"People can be confident that there is no biological, medical, or statistical basis to assert a link between mobile phone use and brain cancer.

....

- **STEWART-Report 2000**

<http://www.iegmp.org.uk/report/text.htm>

[http://www.iegmp.org.uk/documents/iegmp\\_1.pdf](http://www.iegmp.org.uk/documents/iegmp_1.pdf)

#### *Summary and Recommendations*

....

1.53 If there are currently unrecognised adverse health effects from the use of mobile phones, children may be more vulnerable because of their developing nervous system, the greater absorption of energy in the tissues of the head (paragraph 4.37), and a longer lifetime of exposure. In line with our precautionary approach, at this time, we believe that the widespread use of mobile phones by children for non-essential calls should be discouraged. We also recommend that the mobile phone industry should refrain from promoting the use of mobile phones by children.

...

## **Länderübergreifende Forschungsprogramme und nationale Studien (zum Teil noch laufend)**

### *Übersicht*

#### *Studies on RF exposure and well-being*

- Australia: Cross-sectional + prospective **MoRPhEUS** study
- Denmark: (Birth cohort) study, retrospective exposure assessment
- Germany: Cross-sectional **MobilEe** study
- Sweden: Cross-sectional study by Söderqvist et al.
- Finland: Cross-sectional study by Koivusilta et al.
- Germany: Cross-sectional „**QUEBEB**“ Study

#### *Studies on RF exposure and brain tumours*

- Denmark, Norway, Sweden and Switzerland : **CEFALO**
- Europe, Israel, Australia, Canada: **MOBIKIDS**
- Studies in Japan and Great Britain

(aus: Weinmann, T. et al.: Ongoing RF research studies and latest findings where available: Children and adolescents. **Zusammenfassung der Studiendetails siehe dort**)

[http://www.cost-bm0704.eu/index.php?option=com\\_docman&task=doc\\_download&gid=19&Itemid](http://www.cost-bm0704.eu/index.php?option=com_docman&task=doc_download&gid=19&Itemid)

## *Details*

### **CEFALO**

[http://www.research.unibe.ch/abstracts/A\\_65962086.html](http://www.research.unibe.ch/abstracts/A_65962086.html)

International Case Control Study on brain tumors in children and adolescents

Peer reviewed: Kheifets et al. 2005 "The sensitivity of children to electromagnetic fields."

In der **CEFALO-Studie** wird untersucht, ob die Nutzung von Mobiltelefonen das Risiko der Entwicklung eines Hirntumors bei Kindern und Jugendlichen im Alter von 7 bis 19 Jahren erhöht. Dazu wurden **Fall-Kontroll-Studien** in Dänemark, Schweden, Norwegen und in der Schweiz nach einem einheitliche Studienprotokoll im Zeitraum 2004 bis 2008 durchgeführt.

### **Mobile Telecommunications and health research (MTHR), UK**

"Case control study of cancer incidence in early childhood and proximity to mobile phone base stations", 2003 – 2006

[http://www.mthr.org.uk/research\\_projects/mthr\\_funded\\_projects/elliott2.htm](http://www.mthr.org.uk/research_projects/mthr_funded_projects/elliott2.htm)

This study proposes to investigate risk of early childhood cancers (and in particular leukaemia and non-Hodgkin lymphomas (NHL)) among the population residing near mobile phone base stations. A case control approach will be used whereby the residential locations (with respect to mobile phone base stations) of children with cancer (cases) are compared to those without cancer (controls) in England and Wales.

### **MOBI-KIDS**

<http://www.mbkds.com/>, <http://www.creal.cat/fixters/MOBIKIDS-ENG.pdf>

MOBI-KIDS is an international case-control study which aims to assess the potential associations between use of communication devices and other environmental risk factors and brain tumours in young people.

Are communication technologies and environmental exposures risk factors for brain cancer in young people?

Start of international multi-centre study MOBI-KIDS, involving research groups in 13 countries investigating a relationship between communication technologies including mobile phones and environmental factors and brain cancer in young people.

### **MOCEH (The Mothers and Children's Environmental Health Study), Korea**

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2744774/>

Kim BM, Ha M, Park HS, Lee BE, Kim YJ, Hong YC, Kim Y, Chang N, Roh YM, Kim BN, Oh SY, Ha EH; MOCEH Study Group.

Korea

The MOCEH study is a prospective hospital- and community-based cohort study designed to collect information related to environmental exposures (chemical, biological, nutritional, physical, and psychosocial) during pregnancy and childhood and to examine how exposure to environmental pollutants affects growth, development, and disease. The MOCEH network includes one coordinating center, four local centers responsible for recruiting pregnant women, and four evaluation centers (a nutrition center, bio-repository center, neurocognitive development center, and environment assessment center). EMF and cell phone use are, amongst others, included in the physical environmental exposures which are taken into account.

### **MoRPhEUS (Mobile radiofrequency phone exposed users study), Australia**

<http://www.med.monash.edu.au/epidemiology/partnerships/morpheus.html>

This groundbreaking study will follow a cohort of teenagers from Year 7 for an initial period of three years and aims to investigate whether the radiofrequency radiation from mobile phones affects the cognitive ability, blood pressure, or hearing of young users.

*Students will be surveyed three times over three years and will be asked to:*

1. Complete a short questionnaire that asks about the use of both portable cordless phones and mobile phones, social recreation and sporting activities, the environment near the home, and how the student feels about life in general.
2. Complete a set of computer based and verbal tasks that measure reaction time, decision making, working memory, attention, learning, and personality traits.
3. Have measurement of hearing ability and blood pressure, height and weight.

*Parents/guardians of students will be also asked to complete a short questionnaire.*

Student activities will take place during school hours, with the cooperation of the school, and will take approximately one and a half hours.

Results will be published in relevant scientific literature and shared with participating schools.

MoRPhEUS is being conducted (as part of the ACRBR), by Prof. Michael Abramson, A/Prof Malcolm Sim and Dr Geza Benke together with A/Prof Rodney Croft from Swinburne University.

The study is funded by the National Health and Medical Research Council (NHMRC) and approved by the Standing Committee on Ethics in Research involving Humans of Monash University, the Victorian Government Department of Education and Training Research and Innovation Division and Director of the Catholic Education Office Melbourne.

## **Deutsches Mobilfunkforschungsprogramm (DMF) (4 Studien)**

*“Epidemiologische Studie zum Zusammenhang zwischen Kinderkrebs und Expositionen um große Sendeeinrichtungen“*

[http://www.emf-forschungsprogramm.de/forschung/epidemiologie/epidemiologie\\_abges/epi\\_015.html](http://www.emf-forschungsprogramm.de/forschung/epidemiologie/epidemiologie_abges/epi_015.html)

Die Studie ergibt keine Hinweise für ein erhöhtes Kinderleukämierisiko durch die Felder von Fernseh- und Radiosender. Das aussagekräftige Studiendesign der vorliegenden Studie, vor allem die individuelle Expositionsabschätzung für fast 8.000 Kinder, der 20-jährige Beobachtungszeitraum und der Fokus auf 24 der leistungsstärksten Sendeanlagen in Deutschland, schwächt vereinzelte auffällige Befunde früherer weniger belastbarer Studien deutlich ab. Das Fehlen eines bekannten biologischen Wirkmechanismus spricht zusätzlich gegen einen Ursache-Wirkungs-Zusammenhang zwischen hochfrequenter elektromagnetischer Strahlung und Kinderleukämie.

*„Querschnittsstudie zur Erfassung und Bewertung möglicher gesundheitlicher Beeinträchtigungen durch die Felder von Mobilfunkbasisstationen“ („QUEBEB“-Studie)*

- [http://www.emf-forschungsprogramm.de/forschung/epidemiologie/epidemiologie\\_abges/epi\\_020.html](http://www.emf-forschungsprogramm.de/forschung/epidemiologie/epidemiologie_abges/epi_020.html)
- <http://www.quebeb.de/index.php>

Das Quebeb-Projekt ist eine Querschnittsstudie zur Erfassung und Bewertung möglicher gesundheitlicher Beeinträchtigungen durch die elektromagnetischen Felder von Mobilfunkbasisstationen. Es wurde von Arbeitsgruppen der Universitäten Mainz und Bielefeld, des Deutschen Krebsforschungszentrums in Heidelberg sowie TNS-Infratest, München, durchgeführt und vom Bundesamt für Strahlenschutz im Rahmen des Mobilfunkforschungsprogrammes von Okt. 2003 bis Sept. 2006 gefördert.

Es wurden unter anderem Teilanalysen zur Altersgruppe der 14- bis 19-jährigen durchgeführt. Ergebnisse:

- Keinen Zusammenhang zwischen den gemessenen Feldern von Basisstationen und den fünf untersuchten Zielvariablen (Schlafstörungen, Kopfschmerzen, Beschwerden allgemein, gesundheitliche Lebensqualität körperlich und psychisch) gefunden.

- Attribution (das Zurückführen) von gesundheitlichen Beschwerden auf Mobilsendeanlagen ist statistisch signifikant mit Schlafstörungen und Beschwerden allgemein assoziiert, nicht aber mit anderen Zielvariablen.

„Akute Gesundheitseffekte durch Mobilfunk bei Kindern“ („MobilEe“-Studie)

- [http://www.emf-forschungsprogramm.de/www/home/forschung/epidemiologie/epidemiologie\\_abges/epi\\_045.html](http://www.emf-forschungsprogramm.de/www/home/forschung/epidemiologie/epidemiologie_abges/epi_045.html)
- <http://www.ehjournal.net/content/7/1/54>

Die Ergebnisse der Studie geben keine Hinweise auf einen Einfluss der gemessenen Gesamtmobilfunkexposition auf gesundheitliche Beschwerden bei Kindern oder Jugendlichen. Dies gilt sowohl für selbst berichtete Beschwerden der letzten 6 Monate (Kopfschmerzen, Gereiztheit, Nervosität, Schwindel, Müdigkeit, Angst, Einschlafprobleme) als auch für akute Beschwerden am Mittag oder Abend (Kopfschmerzen, Gereiztheit, Nervosität, Schwindel, Müdigkeit, Angst, Einschlafprobleme). Vereinzelt wurde eine Assoziation zwischen subjektiver Mobilfunkbelastung und gesundheitlichen Beschwerden gefunden. Dies unterstreicht, die Wichtigkeit der Bestimmung der objektiven, tatsächlichen Exposition durch Messung. Dies ist die erste Studie, in der die Mobilfunkexposition von Kindern und Jugendlichen gemessen wurde. Insgesamt ist diese sehr niedrig und liegt weit unter den bestehenden Grenzwerten.

„Untersuchungen zu altersabhängigen Wirkungen hochfrequenter elektromagnetischer Felder auf der Basis relevanter biophysikalischer und biologischer Parameter“

[http://www.emf-forschungsprogramm.de/forschung/biologie/biologie\\_abges/bio\\_065.html](http://www.emf-forschungsprogramm.de/forschung/biologie/biologie_abges/bio_065.html)

Die Untersuchung bestätigt einerseits die heutigen Typenprüfungsverfahren für Mobiltelefone (am Kopf) als konservativ, so dass aus den Resultaten in dieser Hinsicht keine Notwendigkeit der Änderungen bestehender Verfahren abzuleiten ist.

Andererseits zeigen die Ergebnisse aber auch, dass v. a. bei jüngeren Kindern im Vergleich zum Erwachsenen in bestimmten Regionen des Gehirns höhere Energieabsorptionen auftreten können. Diese vergleichsweise höheren Belastungen gehen auf die unterschiedlichen anatomischen Gegebenheiten und die geringeren Abstände zwischen Strahlenquelle und Zielstruktur zurück und – mit Ausnahme des Knochenmarks – nicht auf altersabhängige Gewebeeigenschaften. Die Frage, ob diese Unterschiede gesundheitsrelevante Auswirkungen haben, kann diese rein dosimetrische Studie nicht beantworten. Bisherige Ergebnisse aus experimentellen und epidemiologischen Studien weisen nicht auf negative Effekte hin, allerdings wird in diesem Bereich noch Forschungsbedarf gesehen, v. a. was Langzeitwirkungen auf das bei Kindern noch in der Entwicklung befindliche Nervensystem betrifft. Aus den Ergebnissen ergibt sich kein Handlungsbedarf im Sinne einer Absenkung der Grenzwerte oder einer Änderung der Typenprüfungsverfahren, da diese als konservativ bestätigt werden. Allerdings unterstreichen die Ergebnisse die vom BfS gegebenen Empfehlungen zur Expositionsminimierung insbesondere für Kinder. Weitere experimentelle Untersuchungen werden als notwendig erachtet.

## Medienveröffentlichungen

- **The Daily Telegraph, Australien**

“Parents fear mobile towers' exposure is a health risk”, **November 2009**

<http://www.dailytelegraph.com.au/news/parents-fear-mobiles-tower-exposure-is-a-health-risk/story-e6freuy9-1225798360677>

TELECOMMUNICATIONS giants are covertly installing mobile phone towers around kindergartens, schools and childcare centres.

Exploiting a loophole, created 12 years ago when the Federal Government was pushing to roll out mobile broadband, telcos have erected thousands of transmitters without having to get council permission as long as the tower is less than 10m high.

Communities across the eastern seaboard railed against a major tower roll-out in the past year but a new Telstra transmitter proposed for a heritage-listed suburb in Sydney's inner west is expected to challenge, and possibly close, the loophole.

At Summer Hill, Telstra is planning to build a 5.8m tower within 500m of a childcare centre, a kindergarten, two primary schools and an after school care centre catering to hundreds of children. A group of 66 pre-schoolers at the childcare centre, reflecting parents' concerns, carry placards pleading: "Please don't fry my brain".

Research, including a study in the *International Journal of Cancer Prevention*, found the cancer risk was up to 8.5 times higher than average around towers.

The Leukaemia Foundation said towers should be "prudently avoided" while NSW Education Department's policy "prefers" a 500m gap between schools and towers.

People living near transmitters were likely to suffer sleep disorders, headaches, nausea, memory loss, visual disorders, dizziness and vertigo, Summer Hill Action Group spokeswoman Sabiene Heindl said. "We do not have the right to gamble with the health of future generations," she said.

Telstra did not inform childcare director Roberta de Souza of the plan to erect a tower 78m from the children. "We don't let children play near microwaves, we don't let them play with mobile phones," she said.

Ashfield Mayor Ted Cassidy is calling on Telstra to move the tower away from children and wants Communications Minister Stephen Conroy to overhaul the laws.

Telstra said more towers were being rolled out to meet demand for wireless broadband internet.

- **Bayrisches Landesamt für Umwelt**

Bayernweite Aktion "Mobilfunk und Schule" des Bayrischen Staatsministeriums für Umwelt und Gesundheit und des Bayrischen Staatsministeriums für Unterricht und Kultur, **November 2009**  
<http://www.mobilfunkundschule.bayern.de/>

Handy-Messkopf für den Unterricht  
Möglichkeiten der Prävention und Strahlenreduktion  
Fragen zur Biologie

Im Rahmen dieser Aktion können die Schulen vom LfU Lehrmaterial und einen sogenannten SAR-Meßkopf für Messungen der Strahlenbelastung durch Handys kostenlos für den Einsatz im Unterricht ausleihen.

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[Handybroschüre "Coole Tipps für Handykids"](#)

- **Ökotest Online**

„Babyphone – Mama Mia“, **November 2009**  
<http://www.oekotest.de/cgi/index.cgi?artnr=93900;bernr=07;co=>

Eigentlich sind Babyfone dazu da, die Kleinsten zu schützen. Leider produzieren die meisten Geräte im Test aber so viel Elektromog, dass sie sogar schaden könnten. Zum Glück gibt es auch einige "sehr gute" Modelle.

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Inzwischen gehören Babyfone fast schon zur Grundausstattung von Familien mit Kleinkindern. Es gibt sie in den unterschiedlichsten Varianten und Preisklassen - von 20 bis 200 Euro. Laut Gesellschaft für Konsumforschung (GfK) wurden im vergangenen Jahr rund 150.000 Babyfone in Deutschland verkauft. Nicht eingerechnet sind allerdings der Babyfachhandel und Discounter, weshalb das Marktvolumen noch deutlich höher sein dürfte.

Der Haken an der Sache: Die meisten Geräte erzeugen beträchtlichen Elektromog und können so selbst zu Schlafstörungen und gesundheitlichen Schäden beitragen: Sobald ein Gerät mit dem Stromnetz verbunden wird, entstehen elektrische Wechselfelder. Hinzu kommen magnetische Felder, wenn es

eingeschaltet wird und Strom fließt. Außerdem erzeugen Funkbabyfone hochfrequente elektromagnetische Strahlung.

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- **Gesundheitsdepartement Basel-Stadt**

HANDY EXPERT – Jugendbroschüre für einen guten Umgang mit dem Handy, **Oktober 2009**

<http://www.gesundheitsdienste.bs.ch>

Die neu erschienene Broschüre des Gesundheitsdepartements Basel-Stadt liefert praktische Tipps, welche helfen sollen, die Strahlungsbelastung bei der Benutzung des Mobiltelefons minimal zu halten.

- **Wired child, UK**

“Are mobile phones dangerous?”, **Oktober 2009**

<http://wiredchild.org/sciencealias/43-what-the-science-tells-us/66--what-the-science-tells-us-mobile-phones.html>

....All the independently-funded studies that include long terms users have found an association between mobile phone use and an increased risk of brain tumours amongst adults. ...

Research shows that radiation penetrates more deeply into a child´s head and also that children´s skinner skulls absorb much more radiation than an adult´s.....

- **The Collaborative on Health and the Environment – Northwest, USA**

“Northwest children´s environmental health forum”, **Oktober 2009**

<http://www.chenw.org/CEHforum.html>

“What do we really know about how our children are affected by toxic exposures, especially during their critical developmental years?”

The Northwest Children´s Environmental Health Forum brings together a rare group of scientists and policy makers who are on the cutting edge of answering such questions.

#### *Materials*

Cindy Sage, MA      Electromagnetic Fields and the Risk to      [PowerPoint](#)  
Sage Associates      Children's Health      Video

The science and public health implications of chronic exposure to electromagnetic fields and radiofrequency radiation is presented. The inadequacy of existing public safety standards is discussed in relation to public-health concerns about the global rollout of wireless technologies and other sources of exposure.

- **Ärztchammer für Wien**

Handy-Verbot für Kinder unter 6 Jahren

Experten fordern Gesetz zum Schutz unserer Sprösslinge – Strahlung schädlich, **Juli 2009**

<http://www.aekwien.or.at>, <http://www.heute.at>, <http://derstandard.at>,  
<http://www.computerwelt.at/detailArticle.asp?a=123578&n=1>

Ärzte und Erziehungs-Experten schlagen Alarm: Immer mehr Sprösslinge bekommen ein Handy, noch bevor sie überhaupt das ABC gelernt haben. „Die Strahlung kann aber besonders kleinen Kindern schaden. Ein Handyverbot wäre deshalb auf jeden Fall sinnvoll“, meint etwas Erziehungs-Expertin Martina Leibovici-Mühlberger.

Eine Meinung, die auch die Wiener Ärztekammer vertritt: So fordert Erik Huber, Dass die Regierung möglichst rasch gesetzliche Maßnahmen ergreifen soll, um Kinder unter sechs Jahren von Mobiltelefonen fernzuhalten. "Die Industrie setzt immer noch bewusst auf Verharmlosung, während jetzt schon EU-Länder wie Frankreich die möglichen Gefahren erkannt haben", klagt der Umweltmediziner.

Dabei ist die Strahlung der kleinen Hightech-Geräte brandgefährlich: Laut renommierten Studien haben Kinder und Jugendliche sogar ein fünf Mal höheres Risiko, an einem Gehirntumor zu erkranken, als erwachsene Handynutzer.

„Deswegen sollten eigentlich auch Sprösslinge über sechs Jahren, deren Körper sich noch in der Entwicklung befindet, so wenig wie möglich mit Mobiltelefonen in Kontakt kommen“, meint Leibovici-Mühlberger. Ihr Tipp für alle Eltern: „Wichtig ist ein bewusster Umgang, der erst erlernt werden muss. Telefonieren sollte nämlich nur werden, wenn es auch wirklich notwendig ist“, erklärt die Fachfrau.

Die Wiener Ärztekammer hat sich einem von Ärzten und Erziehungs-Experten geforderten Handy-Verbot angeschlossen. Dr. Erik Huber, Referent für Umweltmedizin der Ärztekammer fordert, dass die Regierung möglichst rasch gesetzliche Maßnahmen ergreifen soll, um Kinder unter sechs Jahren von Mobiltelefonen fernzuhalten.

- **You tube**

Rapper warnt vor Folgen des Mobilfunks, **27.07.2009**

Video bei [youtube](#)

Rapper Wojna und seine Band „Die Bandbreite“ thematisieren im Song "Der Handyphob" im Auftrag von gigahertz.ch die Folgen der Mobilfunkstrahlung (Grenzwerte, Hypersensibilität, DNA-Schäden, Hirntumore, usw.).

- **dNews, Amsterdam**

„Bürgermeister schließt Schule wegen Mobilfunkmasts“, **Mai 2009**

<http://www.dnews.de/kuriosa/33474/burgermeister-schliesst-schule-wegen-mobilfunkmasts.html>

... Mobilfunknetzbetreiber haben in Frankreich zunehmend Ärger mit den Behörden. Erst Anfang Februar hatte zum ersten Mal ein französisches Gericht den Abbau eines Sendemasts angeordnet.

Es begründete die Entscheidung damit, dass Strahlenschäden für die Anwohner nicht ausgeschlossen seien. ...

- **ePolitix, UK**

„Potential hazards of wi-fi technology in schools“, **Mai 2009**

<http://www.epolitix.com/latestnews/article-detail/newsarticle/potential-hazards-of-wi-fi-technology-in-schools/>

....

Question: You have strong views on wi-fi in schools, what are your concerns about the potential effects on children?

Philip Parkin: There are a number of them. There seems to be an increasing quantity of evidence being produced around the world which suggests that exposure to electromagnetic radiation can have long-term health impacts both on children and adults but particularly children. Exposing young children (from birth to 12 years of age) to electromagnetic radiation can produce changes in cell formation, genetic changes, and potential cancers.

It is a considerable concern that in schools we are installing wi-fi systems and we have no clear evidence that they are safe. My concern is that until they are declared to be safe and proven to be safe we should not be installing them in schools. The difficulty is that once installed in schools, they are switched on constantly whether the children are using them or not, they are exposed to that level of radiation.

Question: Do you think government has fully grasped the potential long-term consequences of wi-fi in schools?

Philip Parkin: No, the government has not. The government is avoiding the issue. I would not like to say that there are industrial or overriding interests involved in this but there is no question that the large communications organisations are quite powerful. We are not trying to turn back the tide as far as technology is concerned but we have to be sure that as well as doing a job for us, and there is no question that wi-fi does a wonderful job, we have to be absolutely sure that it is safe. This is something the government has not been prepared to grasp.

We have been talking about this for nearly three years. I am very pleased and interested to see that finally some of our colleagues in the other teaching associations have started to show some interest in this. At ATL's conference over Easter a motion was passed mandating their leadership to lobby the government on the potential dangers. I am very pleased to have other people on board with our campaign.

.....

- **Times online, UK**

"Mobile phones to be banned in French primary schools to limit health risks", **Mai 2009**

<http://www.timesonline.co.uk/tol/news/world/europe/article6366590.ece>

Mobile telephones are to be banned from French primary schools, and operators must offer handsets that allow only text messages, under government measures to reduce the health risk to children.

Companies will also be required to supply phones that work only with headsets, to limit the danger to the brain from electromagnetic radiation, Rosalyne Bachelot, the Health Minister, said.

The measures, which emerged from a six-week review of mobile phone and wi-fi radiation, have been attacked as inadequate by campaigners who accuse the State of playing down dangers from phones and transmitter masts. The campaign groups, which walked out on the government consultation on Monday, wanted a ban on mobile use by children under 14 and drastic measures to limit the power and location of masts. ....

- **Coalition for Local oversight of utility technologies (Cloutnow), USA**

"Los Angeles Unified School District Resolutions", **Mai 2009**

<http://www.cloutnow.org/lausd/>, [http://www.cloutnow.org/lausd/pdf/LAUSD\\_Resolution2009.pdf](http://www.cloutnow.org/lausd/pdf/LAUSD_Resolution2009.pdf)

MOTIONS/RESOLUTIONS PRESENTED TO  
THE LOS ANGELES CITY BOARD OF EDUCATION FOR CONSIDERATION

SUBJECT: Wireless Telecommunication Installations

PRESENTED FOR ACTION: 5-26-09

PRESENTED BY: Ms. Korenstein

- **Elektrosmoginfo**

„Mobilfunk und Kinder“, **April 2009**

<http://www.ralf-woelfle.de/elektrosmog/redir.htm?http://www.ralf-woelfle.de/elektrosmog/allgemein/kinder.htm>

- **Pädiatrie und Pädologie**

„Kindergesundheit und Mobilfunk“ von Michael Kundi, **April 2009**

<http://resources.metapress.com/pdf-preview.axd?code=p6815q7p14l52813&size=largest>

Von unnötiger, häufiger und langer Benutzung wird dringend abgeraten.

- **Europäisches Parlament**

„Strahlenschutz verbessern und vereinheitlichen“, **April 2009**  
<http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+IM-PRESS+20090401IPR53233+0+DOC+XML+V0//DE>,

"Immer mehr Bürger sind über die gesundheitlichen Auswirkungen der ständigen Exposition gegenüber Mikrowellen besorgt", konstatiert die Berichterstatterin Frédérique RIES (ALDE-ADLE, Belgien) in ihrem Bericht über elektromagnetische Felder.

*Grenzwerte aktualisieren*

Der Bericht des EP fordert, die potentiellen Gesundheitsprobleme endlich aktiv zu erforschen und die Veröffentlichung entsprechender Studien nicht zu verzögern. Da die Wissenschaft immer noch darüber, streite, welchen Einfluss elektromagnetische Strahlen auf den menschlichen Organismus haben, sei es notwendig, die 1999 vom Rat beschlossenen wissenschaftlichen Grenzwerte zu überprüfen und gegebenenfalls zu aktualisieren. Zudem müsse die Kommission einen jährlichen Bericht über "das Ausmaß der elektromagnetischen Strahlung in der EU" sowie ihre Quellen und die getroffenen Maßnahmen vorlegen.

*Präventiv-Schutz und Harmonisierung*

Doch schon heute könnten Unternehmen und Behörden dazu beitragen, den Einfluss der Strahlen zu vermindern, etwa durch entsprechenden Abstand und Höhe von in der Nähe von Wohngebieten stehenden Sendemasten. Abgesehen von den gemeinsamen Grenzwerten ist es derzeit jedoch den Mitgliedsstaaten überlassen, wie viel sie für den Schutz ihrer Bürger tun. Berichterstatterin Ries stellt fest, dass etwa in Luxemburg besonders hohe Standards gelten, in vielen anderen Ländern hingegen weniger auf die Sicherheit geachtet werde. EU-Kommission und Mitgliedsstaaten müssten deshalb entsprechende Leitlinien für die gesamte EU erarbeiten oder zumindest einheitliche Mindeststandards festlegen, wie z. B. ein Verbot, Sender in unmittelbarer Nähe von "Schulen, Kindertagesstätten, Seniorenheimen und Einrichtungen der Gesundheitsfürsorge" aufzustellen.

*Mehr Information und Transparenz*

Zudem hält es das Parlament für sinnvoll, öffentlich zugängliche Karten mit der Lage von Hochspannungsleitungen und Sendemasten zur Verfügung zu stellen. Gefordert wird auch eine bessere Verbraucherinformation: So soll nach dem Willen der Abgeordneten auf Produkten, wie beispielsweise drahtlosen Geräten, zukünftig auch die Emissionsstärke angegeben werden. Auch müsse dafür Sorge getragen werden, dass die Bürger besser über "Drahtlostechnologie und Schutzvorschriften" informiert sind.

559 Abgeordnete stimmten für den Bericht, 22 dagegen, 8 enthielten sich der Stimme.

- **itp.net**

"Teachers in the UK are calling for the government to remove wi-fi networks from schools over fears that wireless could be harmful to health.", **April 2009**  
<http://www.itp.net/573427-wi-fi-scare-stories?tab=blog>

... "Dr. Michael Clark of the UK's Health Protection Agency spelled out the risks: "When we have conducted measurements in schools, typical exposures from wi-fi are around 20 millionths of the international guideline levels of exposure to radiation. As a comparison, a child on a mobile phone receives up to 50% of guideline levels. So a year sitting in a classroom near a wireless network is roughly equivalent to 20 minutes on a mobile. If wi-fi should be taken out of schools, then the mobile phone network should be shut down, too - and FM radio and TV, as the strength of their signals is similar to that from wi-fi in classrooms."....

- **The Independent, UK**

"French government bans advertising of mobiles to children", **Januar 2009**

<http://www.independent.co.uk/life-style/gadgets-and-tech/news/french-government-bans-advertising-of-mobiles-to-children-1299673.html>

New limits will be placed on radiation levels amid fears of increased risk of cancer from phone use  
By Geoffrey Lean, Environment Editor

New laws cracking down on children's use of mobile phones are to be introduced in France amid growing fears that they may cause cancer and other diseases.

All advertising of the devices to children under 12 is to be prohibited under the legislation – announced by the Environment Minister, Jean-Louis Borloo, last week – and he will also take powers to ban the sale of any phone designed to be used by those under six.

The French government will also introduce new limits for radiation from the phones and make it compulsory for handsets to be sold with earphones, so that users can avoid irradiating their heads and brains. And one of the country's largest cities last month started an advertising campaign to discourage the use of the phones by children.

The clampdown represents the most comprehensive action yet taken by any government worldwide. It contrasts sharply with the stance of British ministers, who have largely ignored the recommendations of an official report nine years ago that people aged under 16 should be discouraged from using mobiles, and that the industry should be stopped from promoting them to children. Since then their use by the young has almost doubled, so that nine out of 10 of the country's 16-year-olds own a handset.

Swedish research indicates that children and teenagers are five times more likely to get brain cancer if they use the phones, causing some experts to predict an "epidemic" of the disease among today's young people in later life. But consideration of the threat to them has been specifically excluded from Britain's official £3.1m investigation into the risk of cancer from mobiles.

The French ministry warned that "mobile phone use is increasing at a rapid pace among youths", and warns that the young may be "more sensitive because their bodies are still developing". Children's heads are smaller and their skulls thinner.

Lyon, France's second city, launched an advertising campaign before Christmas aimed at dissuading people from buying mobiles for children as presents, with the slogan "Let's keep them healthy, away from mobile phones!"

A year ago France's official Agency for Environmental and Occupational Health Safety said that parents should not give small children mobiles. And France's Health Ministry urged using them in moderation. The French legislation is the latest evidence of growing official alarm at the hazards of the radiation caused by mobile phone use. In September, the European Parliament voted 522 to 16 to urge ministers across Europe to bring in stricter radiation limits, and the European Environment Agency has also issued a warning.

Toronto's Department of Public Health has advised that children under eight should only use mobiles in emergencies and teenagers should limit calls to less than 10 minutes. The Russian Ministry of Health says that young people under 18 should not use the devices, and Israel's Health Ministry has also advised caution.

- **Dr. Ben Kim (chiropractor and acupuncturist in Ontario, Canada)**

"Nations Warning against and Banning Cell Phone Use in Children", **Januar 2009**

<http://drbenkim.com/cell-phone-warnings.htm>, <http://www.chetday.com/cellphonewarning.htm>

While nations around the world are either banning or limiting cell phone use by children, and some by those under the age of 12 years-old, Health Canada has remained mum on the subject.

France is nearing the point where it will make it illegal to market cell phones to children.

Russian officials have recommended that children under the age of 18 years not use cell phones at all. Similarly, the United Kingdom, Israel, Belgium, Germany and India have discouraged use of cell phones by children.

In Finland, the Radiation and Nuclear Power Authority has urged parents to err on the side of caution, because despite there being no definitive research indicating health risks related to the use of cell phones, there is also no definitive research indicating the absence of health risks from cell phone use. The truth is, cell phone use, and especially its wide use among children, is a relatively new phenomenon which has not yet enabled study of possible long term effects.

CBC-TV conducted a survey of 1,000 children in Canada; the results indicated that almost half of the children in the 9-13 year-old range have cell phones.

An epidemiologist, Professor Devra Davis, at the University of Pittsburgh Cancer Institute has been quoted as stating, "Because the latency between exposure and brain cancer could be 20 or 30 years...we are basically treating ourselves like lab rats in an experiment without any controls" (CBCNews.ca. 2009, January 22).

The fact is, children's brains are less dense--more porous--than adult brains. Radio frequency signals penetrate a child's brain more deeply than they do an adult's brain. Scans have confirmed that the low-level radiation emitted by cell phones penetrate the brain of a 5-year-old child more than halfway through.

Source: *CBCnews.ca (2009, January 22). "Health Canada has little to say about cellphone risks for kids".*

Note from Ben Kim: Another reason for keeping cell phones away from children is that the bones that make up their skulls are thinner than those of adults. Consequently, children have less protection against deep penetration of radio frequency signals into their brains.

Here are a few additional thoughts on minimizing exposure to radio frequency signals:

1. The greatest exposure to radiation from a cell phone occurs within about half a foot of the emitting antenna, so be sure to keep your cell phone at least six inches away from all of your body parts whenever it's turned on.
2. When you must use a cell phone, try to use it where reception is strong; weak reception requires that your phone emits more radiation, which leads to stronger radio waves that can affect your deeper tissues.
3. Use a headset or at the very least, the speaker phone function when you must use your cell phone.
4. When you're not using your cell phone, keep it turned off. Cell phones that are not in use but left on emit radiation on an intermittent basis.
5. Minimize use of all other wireless devices, including cordless phones at home and at work. If you must use a wireless/cordless phone, choose an older version that operates at 900 MHz - though such phones still emit harmful waves when in use, they don't broadcast nonstop like higher frequency phones (2.4 GHz, 5.8 GHz, etc.).

If you're interested in getting a simple device - called a Gauss meter - that you can use to detect EMF activity around cell phones, cordless home phones, and other wireless devices, have a look at the [Cell Sensor EMF Detector](#) - it's relatively inexpensive, and it's what I use to look for "hot spots and devices" in our home and office from time to time.

Holding a Cell Sensor EMF Detector up against a cell phone and having it give off a strong and steady beep is a good way to help children and skeptical adults become more aware of the presence of electromagnetic fields.

- **Mobile Manufacturers Forum (MMF)**

„Mobile Phone Safety and Use by Children“, **November 2008**

[http://www.mmfai.org/public/docs/eng/MMF\\_MobilePhoneSafetyAndUseByChildren\\_Nov08.pdf](http://www.mmfai.org/public/docs/eng/MMF_MobilePhoneSafetyAndUseByChildren_Nov08.pdf)

All of the reviews over the last ten years by expert panels and government agencies have agreed that the scientific evidence does not demonstrate any health risks from the use of mobile phones and base stations operating within international guidelines. This is true regardless of age.

While the political and scientific discussion will continue, it is clear that parents are deciding for themselves whether their children should use a mobile phone or not. Many parents allow their use because of the benefits in terms of safety and security that mobile phones provide for both children and parents.

For our part, the MMF believes that there is a strong scientific basis for all consumers to have confidence in the safety of mobile phones and base stations. In addition, we fully support parents deciding for themselves whether they want their children to use a mobile phone or not.

- **IDW (Informationsdienst Wissenschaft)**

"Ergebnisse von Expertenworkshop in Stuttgart: Sind Kinder und Jugendliche besonders empfindlich gegenüber hochfrequenten Feldern?", **Dezember 2006**

<http://www.idw-online.de/pages/de/news189469>

Die bisher vorliegenden Forschungsergebnisse zur Einwirkung elektromagnetischer Felder speziell auf Kinder und Jugendliche geben derzeit keinen Anlass zur Besorgnis für den Umgang mit der Mobilfunktechnik. Das ist das Fazit eines internationalen Workshops vom 27. - 29. November 2006 in Stuttgart, an dem rund 50 Wissenschaftler aus Europa, Australien, den USA und Japan sowie Vertreter nationaler und internationaler Strahlenschutzgremien teilnahmen. Da auf manchen Gebieten die Datenlage aber noch unzureichend ist, forderten die Wissenschaftler weitere Forschung und mehr internationale Kooperation.

In 16 Fachvorträgen wurden die Fragestellung, ob Kinder und Jugendliche besonders empfindlich gegenüber Hochfrequenzfeldern sind, anhand aktueller Ergebnisse aus der Dosimetrie und Expositionsabschätzung, aus Tier- und Freiwilligenstudien sowie aus der Epidemiologie dargestellt und diskutiert.

Die Workshop-Beiträge zum Thema Dosimetrie fokussierten auf die Frage, ob Kinder und Jugendliche Hochfrequenz-Strahlung anders absorbieren als Erwachsene und welches Computermodell geeignet ist, um die Expositionsverhältnisse zuverlässig zu berechnen. Die Datenlage zur Expositionsabschätzung spezifischer Gewebereiche, besonders im Kopf von Kindern, ist derzeit noch unzureichend. Hier sehen die Experten noch weiteren Forschungsbedarf, betonten aber, dass trotz aller Meinungsunterschiede in der Bewertung eventueller spezieller Risiken Kinder und Jugendliche durch die derzeit gültigen Grenzwerte ausreichend geschützt sind.

Auch die Auswertung der bisher durchgeführten Studien an Erwachsenen und Kindern geben keine Hinweise auf gesundheitlich relevante Effekte. Vereinzelt festgestellte Veränderungen bei Gehirnströmen (EEG-Messungen) und im Schlafrhythmus sowie mögliche Langzeiteffekte müssen noch genauer untersucht werden.

Die Datenlage aus Bevölkerungserhebungen ist derzeit für Kinder und Jugendliche ebenfalls noch unzureichend, da diese erst seit wenigen Jahren Mobiltelefone so intensiv wie oder sogar intensiver als Erwachsene nutzen. Neu initiierte Studien, mit denen aussagekräftige Daten über junge Mobilfunknutzer gewonnen werden sollen, wurden auf der Tagung vorgestellt.

Ein Kurzbericht über den Workshop informiert über weitere Details der Tagung. Er kann von der Seite <http://www.fgf.de/fup/tagung/fgfworkshops-start.html> heruntergeladen werden.

Die Kurzzusammenfassungen aller Vorträge sowie die Präsentationen vom Workshop sind (in englischer Sprache) online auf der Seite [http://www.cost281.org/documents.php?node=153&dir\\_session=](http://www.cost281.org/documents.php?node=153&dir_session=) verfügbar.

- **Edition Wissenschaft, Ausgabe Nr. 22, November 2005**

"Sensibilität von Kindern gegenüber EMF-Exposition – Gibt es eine erhöhte Sensibilität gegenüber hochfrequenten Feldern der mobilen Kommunikation während diskreter Entwicklungsphasen?"

Von Dr. med. Jörg Reußenweber, Janine Pöss und Prof. Dr. med. Eduard David

<http://www.fgf.de/publikationen/edition-wissenschaft/ew051022.html>

*Summary*

At present, the question of whether developmental phases of increased sensitivity to high frequency electromagnetic fields during the development, formation and growth of the human body exist is a relevant one. The scientific community is not near the end of the deliberation process. Paediatrics, anatomy and physiology are invoked to conduct further research and to provide novel insights into the interactions between HF electromagnetic fields and the developing human organism.

It was the objective of this publication to outline the state of the art in this field. This included an overview of the general paediatric and medical aspects of children's growth and development. The overview dealt with the question whether the risk assessment of children in high-frequency EMF differs from that of adult persons. An important aim should consist in identifying putative sensitive phases or

weak points of the human body during which electromagnetic fields might be able to provoke harmful effects on the health or the wellbeing of children and adolescents. Thus tests must be carried out to whether periods of growth or spans of life (crucial phases or time windows) may need to be specifically assessed.

From the medical point of view and on the basis of present knowledge, there is no justified reason or plausible suspicion of severe health hazards for the developing organism from exposure to HF electromagnetic fields from mobile communications. From the present state of knowledge the recommendation cannot be justified that children and adolescents must be particularly careful using mobile phones a priori. Nevertheless - for psychological reasons - children and adolescents are invoked to a „conscious“ use of mobile phones. That there is a need for further research in this field is clear, as not many studies have been carried out in this field up to now. It is worth performing more detailed research projects in future to obtain more evidence.

Sound scientific knowledge is the only method to restore a feeling of safety to the general public, which has been concerned about the matter for several years now. The question for the existence of „plateau phases“ of increased sensitivity of discrete biomedical parameters during the developmental phases of the human organism must remain open. Further scientific research therefore seems justified. Even the still unresolved phenomenon of self-reported electromagnetic hypersensitivity can be mentioned in this context.

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