

Radio Wave Packet

by

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SOME BIOLOGICAL EFFECTS OF RADIO WAVES

Power density ($\mu\text{W}/\text{cm}^2$)	Reported Biological Effects	References
0.00000000000001	Altered genetic structure in E. Coli	Belyaev 1996
0,0000000001	Threshold of human sensitivity	Kositsky 2001
0.000000001	Altered EEG in human subjects	Bise 1978
0.0000000027	Growth stimulation in Vicius fabus	Brauer 1950
0.000000001	Effects on immune system in mice	Bundyuk 1994
0.000000002	Stimulation of ovulation in chickens	Kondra 1970
0.000005	Effect on cell growth in yeast	Grundler 1992
0.00001	Conditioned “avoidance” reflex in rats	Kositsky 2001
0.000027	Premature aging of pine needles	Selga 1996
0.001	100 Yards from a Cellular Phone	
0.002	Sleep disorders, abnormal blood pressure, nervousness, weakness, fatigue, limb pain, joint pain, digestive problems, fewer schoolchildren promoted—controlled study near a shortwave transmitter	Altpeter 1995, 1997
0.0027	Growth inhibition in Vicius fabus	Brauer 1950
0.0027 to 0.065	Smaller tree growth rings	Balodis 1996
0.007	50 Feet from a Cordless Phone	
0.01	Human sensation	Kolbun 1987
0.016	1 Mile from a Cellular Tower	
0.06	Altered EEG, disturbed carbohydrate metabolism, enlarged adrenals, altered adrenal hormone levels, structural changes in liver, spleen, testes, and brain—in white rats and rabbits	Dumanskij 1974
0.06	Slowing of the heart, change in EEG in rabbits	Serkyuk, reported in McRee 1980
0.05	10 Feet from a Wireless Computer	
0.1	Increase in melatonin in cows	Stark 1997
0.1 to 1.8	Decreased life span, impaired reproduction, structural and developmental abnormalities in duckweed plants	Magone 1996
0.13	Decreased cell growth (human epithelial amnion cells)	Kwee 1997
0.168	Irreversible sterility in mice	Magras 1997
0.2 to 8.0	Childhood leukemia near transmitters	Hocking 1996
0.3	Impaired motor function, reaction time, memory and attention of schoolchildren, and altered sex ratio of children (fewer boys)	Kolodynski 1996
0.6	Change in calcium ion efflux from brain tissue	Dutta 1986
0.6	Cardiac arrhythmias and sometimes cardiac arrest (frogs)	Frey 1968
0–4	Altered white blood cell activity in schoolchildren	Chiang 1989
1.0	Headache, dizziness, irritability, fatigue, weakness, insomnia, chest pain, difficulty breathing, indigestion (humans—occupational exposure)	Simonenko 1998
1.0	Stimulation of white cells in guinea pigs	Shandala 1978
2.5	Breakdown of blood-brain barrier (used a digital cellular phone to provide the radiation)	Salford 1997
5.0	Leukemia, skin melanoma and bladder cancer near TV and FM transmitter	Dolk 1997

2.0 (lower threshold not known)	“Microwave hearing”—clicking, buzzing, chirping, hissing, or high-pitched tones	Frey 1963, 1969, 1971, 1973, 1988, Justeson 1979, Olsen 1980, Wieske 1963, Lin 1978
5.0	Biochemical and histological changes in liver, heart, kidney, and brain tissue	Belokrinitskiy 1982
10.0	Damaged mitochondria, nucleus of cells in hippocampus of brain	Belokrinitskiy 1982a
10~0	Impaired memory and visual reaction time in people living near transmitters	Chiang 1989
10.0	Decreased size of litter, increased number of stillborns in mice	Il’Chevich (reported in McRee 1980)
10.0	Redistribution of metals in the lungs, brain, heart, liver, kidney, muscles, spleen, bones, skin, blood	Shutenko 1981
1000.0	FCC Exposure Limit	

INTERNATIONAL RADIO WAVE EXPOSURE STANDARDS

Country	Exposure level ($\mu\text{W}/\text{cm}^2$)
New South Wales, Australia	0.001
Salzburg, Austria (for pulsed transmissions)	0.1
Russia	2–10
Bulgaria	2–10
Hungary	2–10
Switzerland	2–10
China	7–10
Italy	10
Auckland, New Zealand	50
Australia	200
New Zealand	200–1000
Japan	200–1000
Germany	200–1000
United States	200–1000
Canada	200–1000
United Kingdom	1000–10,000

RADIO WAVE SICKNESS

Symptoms

Insomnia, headaches, dizziness, nausea, memory loss, difficulty concentrating, irritability, respiratory illness (bronchitis, sinusitis, pneumonia), flu-like illness, asthma, fatigue, weakness, pressure or pain in the chest, increase in blood pressure, altered pulse rate (usually slowed), pressure behind the eyes, other eye problems, swollen throat, dry lips or mouth, dehydration, sweating, fever, shortness of breath, muscle spasms, tremors, pain in the legs or the soles of the feet, testicular or pelvic pain, joint pain, pains that move around the body, nosebleeds, internal bleeding, hair loss, digestive problems, skin rash, ringing in the ears, impaired sense of smell, pain in the teeth (especially with metallic fillings)

Scientific Studies

Clinical studies of workers exposed on the job

Sadchikova	1960	525 workers exposed to microwave generating equipment
Sadchikova	1974	1180 workers
Klimkova-Deuschova	1974	530 workers from 29 places of employment
Baranski and Edelwejn	1975	Workers in the Military Institute of Aviation Medicine, Warsaw
Zalyubovskaya and Kiselev	1978	Study of 72 engineers and technicians
Bachurin	1979	100 television, radio and other workers
Sadchikova	1980	50 industrial workers
Chiang	1981	841 workers in 11 factories
Gorbach	1982	142 workers exposed to microwave equipment
Trinos	1982	2247 workers at two industrial plants
Markarov	1995	53 workers exposed to low-dose radio waves

Epidemiological studies

Lilienfeld	1978	Employees in the American embassy in Moscow
Flakiewicz	1992	Residents near a long wave transmitter at Konstanynow, Poland
Altpeter	1995, 1997	Residents who lived near a shortwave radio station at Schwarzenburg, Switzerland
Kolodynski et al.	1996	Residents near an early warning radar station at Skruna, Latvia
Hocking	1998	Users of cellular telephones—includes several reports of strokes
Mild	1998	Users of cellular telephones

Reports to the Cellular Phone Taskforce

Since digital cellular phones (and towers) came to the United States in November 1996, the symptoms of radio wave sickness have become epidemic in all major cities and near most wireless facilities. The above list of symptoms includes the symptoms reported throughout the scientific literature, plus some new ones based on what we are hearing and experiencing, from throughout the world.

History of This Illness

The term “radio wave sickness” was first used by Russian doctors to describe an occupational illness developed by large numbers of workers exposed to microwave or radiofrequency radiation. The symptoms were called “neurasthenic.” “Neurasthenia” was an older term for this group of symptoms, which was coined by an American physician, George Beard, in 1868, to describe a new type of illness that followed the building of the railroads and the telegraph system in this country. The illness was particularly common among telegraph, and later among telephone operators. The term “neurasthenia” fell out of fashion in the twentieth century in this country, when this cluster of symptoms, or a large number of them, began to be referred to as “anxiety” symptoms, presumably of purely psychological origin. Illness by radio waves has been rediscovered, and is now classed with illness caused by electricity in general, under the term “electrical sensitivity.” There have been four international scientific conferences held in recent years on electrical sensitivity—one in Austria, two in Denmark, and one, for medical doctors, in Dallas, Texas. Two books exist on the subject, by Grant (1995) and Bergqvist (1997).

REFERENCES

- Altpeter, E. S. et al., 1995. Study on health effects of the shortwave transmitter station of Schwarzenburg, Berne, Switzerland, Study No. 55, Swiss Federal Office of Energy.
- Bachurin, I. V., 1979. Influence of small doses of electromagnetic waves on some human organs and systems. *Vrachebnoye Delo* 7:95-97, JPRS 75515, pp. 36-39.
- Balodis, V. et al., 1996. Does the Skrunda Radio Location Station diminish the radial growth of pine trees? *The Science of the Total Environment* 180:81-85.
- Baranski, S. and Edelwejn, Z., 1975. Experimental morphologic and EEG studies of microwave effects on the nervous system. *Annals of the New York Academy of Sciences* 247:109-116.
- Belokrinitskiy, V.S., 1982. Hygienic evaluation of biological effects of nonionizing microwaves. *Gigiyena i Sanitariya* 6:32-34, JPRS 81865, pp. 1-5.
- Belokrinitskiy, V. S., 1982a. Destructive and reparative processes in hippocampus with long-term exposure to nonionizing microwave radiation. *Bulletin of Experimental Biology and Medicine* 93(3):89-92.
- Belyaev, I. Y., et al., 1996. Resonance effect of millimeter waves in the power range from 10^{-19} to 3×10^{-3} W/cm² on Escherichia coli cells at different concentrations. *Bioelectromagnetics* 17:312-321.
- Bergqvist, U., and Vogel, E., eds. *Possible Health Implications of Subjective Symptoms and Electromagnetic Fields*. Solna, Sweden: National Institute for Working Life, 1997.
- Bise, W., 1978. Low power radio-frequency and microwave effects on human electroencephalogram and behavior. *Physiological Chemistry and Physics* 10(5):387-398.
- Brauer, I., 1950. Experimental studies on the effect of meter waves of various field intensities on the growth of plants by division. *Chromosoma* 3:483-509.
- Bundyuk, L.S., et al., 1994. Corrective action of millimeter waves on systems of various levels of hierarchy. *Physics of the Alive* 2(1):12-25.
- Chiang, H., 1981. Assessment of health hazard and standard promulgation in China. *Biological Effects and Dosimetry of Nonionizing Radiation*, NATO Conference, Erice, Italy, pp. 627-644.
- Chiang, H., et al., 1989. Health effects of environmental electromagnetic fields. *Journal of Bioelectricity* 8(1):127-131.
- Dolk, H, et al., 1997. Cancer incidence near radio and television transmitters in Great Britain, I. Sutton Coldfield transmitter. *American Journal of Epidemiology* 145(1):1-9.
- Dumanskiy, J. D., and Shandala, M. G., 1974. The biologic action and hygienic significance of electromagnetic fields of super-high and ultrahigh frequencies in densely populated areas. *Biologic Effects and Health Hazards of Microwave Radiation, Proceedings of an International Symposium*, Warsaw, 15-18 Oct. 1973, P. Czernski et al., eds.
- Dutta, S. K., et al, 1986. Microwave radiation-induced calcium ion flux from human neuroblastoma cells: dependence on depth of amplitude modulation and exposure time. *Biological Effects of Electropollution*, S. Dutta and R. Millis, eds., pp. 63-69. Philadelphia, PA: Information Ventures.

- Flakiewicz, W., and Cebulska-Wasilewska, A., 1992. Biological effects of EM field on randomly selected human population residing permanently close to the high power, long wave radio transmitter, and *Trandescantia* plant model system in situ. *International Wroclaw Symposium on Electromagnetic Compatibility*, pp. 72-76.
- Frey, A. H., 1963. Human response to very-low-frequency electromagnetic energy. *Nav. Res. Rev.* 1968:1-4.
- Frey, A. H., and Seifert, E., 1968. Pulse modulated UHF energy illumination of the heart associated with change in heart rate. *Life Sciences* 7(Part II):505-512.
- Frey, A. H., 1968. Effects of microwave and radio frequency energy on the central nervous system. Symposium Proceedings. *Biological Effects and Health Implications of Microwave Radiation*, Richmond, VA, Sept. 1969, pp. 134-139.
- Frey, A.H., 1971. Biological function as influenced by low power modulated RF energy. *IEEE Transactions on Microwave Theory and Techniques*, MTT-19(2):153-164.
- Frey, A. H., and Messenger, R., 1973. Human perception of illumination with pulsed ultrahigh-frequency electromagnetic energy. *Science* 181:356-358.
- Frey, A. H., 1986. Evolution and results of biological research with low-intensity nonionizing radiation. *Modern Bioelectricity*, A. A. Marino, ed., pp. 785-837. New York, NY: Dekker.
- Gorbach, I. N., 1982. Changes in nervous system of individuals exposed to microradiowaves for long period of time. *Zdravookhraneniye Belorussii* 5:51-53, JPRS 81865, pp. 24-28.
- Grant, L., 1995. *Electrical Sensitivity Handbook*. Prescott, AZ: Weldon Publishing.
- Grundler, W., and Kaiser, F., 1992. Experimental evidence for coherent excitations correlated with cell growth. *Nanobiology* 1:163-176.
- Hocking, B., and Gordon, I., 1996. Cancer incidence and mortality and proximity to TV towers. *Medical Journal of Australia* 165(11-12):601-605.
- Hocking, B., 1998. Symptoms associated with mobile phone use, *Occupational Medicine* 48(6):357-360, and letter, vol. 48(7):472.
- Justeson, D. R., 1979. Behavioral and psychological effects of microwave radiation. *Bulletin of the New York Academy of Medicine* 55(11):1058-1078.
- Klimkova-Deutschova, E., 1974. Neurologic findings in persons exposed to microwaves. *Biologic Effects and Health Hazards of Microwave Radiation, Proceedings of an International Symposium*, Warsaw, 15-18 Oct. 1973, P. Czerski et al., eds., pp. 268-272.
- Kolbun, N. D, and Sit'ko, S. P., 1987. Sensory indications by the human body of EHF-range electromagnetic radiation. *Mechanisms of Biological Action of Electromagnetic Radiation: Proceedings of the Pushchino Symposium*, 27-31 Oct. 1987.
- Kolodynski, A. A., and Kolodynska, V. V., 1996, Motor and psychological functions of school children living in the area of the Skrunda Radio Location Station in Latvia. *The Science of the Total Environment* 180:87-93.

- Kondra, P. A., et al., 1970. Growth and reproduction of chickens subjected to microwave radiation. *Canadian Journal of Animal Science* 50:639-644.
- Kositsky, N. N., et al., 2001. Influence of high-frequency electromagnetic radiation at non-thermal intensities on the human body (a review of work by Russian and Ukrainian researchers). *No Place To Hide* 3(1) Supplement.
- Kwee, S., and Raskmark, P. , 1997. Radiofrequency electromagnetic fields and cell proliferation. In *Proceedings of the Second World Congress for Electricity and Magnetism in Biology and Medicine*, June 8-12, 1997, Bologna, Italy, F. Bersani, ed.
- Lilienfeld, A. M., 1978. *Evaluation of Health Status of Foreign service and Other Employees from Selected Eastern European Posts*, National Technical Information Service, PB288-163.
- Lin, J. C., 1970. *Microwave Auditory Effects and Applications*. Springfield, IL: Charles C. Thomas.
- Magone, I., 1996. The effect of electromagnetic radiation from the Skrunda Radio Location Station on *Spirodela polyrhiza* (L.) Schleiden cultures. *The Science of the Total Environment* 180:75-80.
- Magras, I. N., and Xenos, T. D., 1997. RF radiation-induced changes in the prenatal development of mice. *Bioelectromagnetics* 18:455-461.
- Marha, H., 1969. Maximum admissible values of HF and UHF electromagnetic radiation at work places in Czechoslovakia. Symposium Proceedings. *Biological Effects and Health Implications of Microwave Radiation*. Richmond, VA, Sept. 1969, S. Cleary, ed., pp. 188-191.
- Markarov, G., et al., 1995. Hypersensitivity to EMF, and the dependence of brain bioelectrical activity and general hemodynamics in cerebral asthenic (CA) patients, exposed to radioactive irradiation upon EMF 20-80 Hz effect, *Proceedings of the 2nd Copenhagen Conference on Electromagnetic Hypersensitivity*, May 1995. J. Katajainen and B. Knave, eds., pp. 57-60.
- Mild, K. H., et al., 1998. Comparison of symptoms experienced by users of analogue and digital mobile phones. A Swedish-Norwegian epidemiological study. 1998:23. Umea, Sweden: National Institute for Working Life
- Olsen, R. G., 1980. Evidence for microwave-induced acoustic resonances in biological material. *Bioelectromagnetics* 1:219.
- Proceedings of the COST 244 Meeting on Electromagnetic Hypersensitivity*, Graz, Austria, Sept. 26-27, 1994, Dina Simunic, ed.
- Proceedings: 15th Annual International Symposium on Man and His Environment in Health and Disease: Environmental Aspects of EMF and Bioelectricity*, American Environmental Health Foundation, February 20-23, 1997, Dallas, Texas.
- Proceedings: First Copenhagen Meeting on Electromagnetic Hypersensitivity*, 1994. Danish Assoc. for the Electromagnetically Hypersensitive, c/o Aase Thomassen, Lunden 1, Alum, DK-8900, Randers, Denmark.
- Proceedings: Second Copenhagen Conference on Electromagnetic Hypersensitivity*, 1995. Danish Assoc. for the Electromagnetically Hypersensitive.

Sadchikova, M. N., State of the nervous system under the influence of UHF. *The Biological Action of Ultrahigh Frequencies*, A.A. Letavet and Z.V. Gordon, eds., Academy of Medical Sciences, Moscow, pp. 25-29.

Sadchikova, M. N., Clinical manifestations of reactions to microwave radiation in various occupational groups. *Biologic Effects and Health Hazards of Microwave Radiation, Proceedings of an International Symposium*, Warsaw, 15-18 Oct. 1973, P. Czerski et al., eds., pp. 261-267.

Sadchikova, M. N., et al., 1980. Significance of blood lipid and electrolyte disturbances in the development of some reactions to microwaves. *Gigiyena Truda i Professional'nyye Zabolevaniya* 2:38-39, JPRS 77393, pp. 37-39.

Salford, L. G., et al., 1997. Blood brain barrier permeability in rats exposed to electromagnetic fields from a GSM wireless communication transmitter. In: *Proceedings of the Second World Congress for Electricity and Magnetism in Biology and Medicine*, June 8-12, 1997, Bologna, Italy, F. Bersani, ed.

Selga, T., and Selga, M., Response of *Pinus sylvestris* L. needles to electromagnetic fields. Cytological and ultrastructural aspects. *The Science of the Total Environment* 180:65-73.

Shandala, M.G., and Vinogradov, G. I., 1978. Immunological effects of microwave action. *Gigiyena i Sanitariya*, no. 10:34-38, JPRS 72956, pp. 16-21.

Shutenko, O. I., et al., 1981. Effects of superhigh frequency electromagnetic fields on animals of different ages. *Gigiyena i Sanitariya*, no. 10:35-38, JPRS 84221, pp. 85-90.

Simonenko, V. B., et al., 1998. Influence of electromagnetic radiation in the radiofrequency range on the health condition of an organized collective. *Voенno-meditsinskiy zhurnal CCCXIX(5):64-68*.

Stark, K., et al., 1997. Absence of chronic effect of exposure to short-wave radio broadcast signal on salivary melatonin concentrations in dairy cattle. *Journal of Pineal Research* 22:171-176.

Trinos, M. S., 1982. Frequency of diseases of digestive organs in people working under conditions of combined effect of lead and SHF-range electromagnetic energy. *Gigiyena i Sanitariya*, no. 9:93-94, JPRS 84221, pp. 23-26.

Wieske, C. W., 1962. Human sensitivity to electric fields. In *Proceedings of the First National Biomedical Sciences Instrumentation Symposium*, Los Angeles, July 14-17, 1962, Reprinted in *Electrical Sensitivity News* 1(5):1-4, 1996.

Zalyubovskaya, N. P., and Kiselev, R. I., 1978. Effect of radio waves of a millimeter frequency range on the body of man and animals. *Gigiyena i Sanitariya* 8:35-39, JPRS 72956, pp. 9-15.

For a much more extensive review of the literature on this subject, see *Microwaving Our Planet: The Environmental Impact of the Wireless Revolution*, Arthur Firstenberg, 1997, \$18 from the Cellular Phone Taskforce, P.O. Box 100404, Brooklyn, New York 11210, or P.O. Box 1337, Mendocino, CA 95460.