La règlementation des antennes de télécommunication à Montréal : la nécessité du principe de précaution dans un contexte problématique.

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Produit à titre citoyen

Résumé:

Les antennes de télécommunication sont une source d'exposition au rayonnement électromagnétique. L'exposition chronique à ce rayonnement est réputé avoir des effets délétères plus ou moins importants, souvent réversibles; des effets handicapants d'un point de vue fonctionnel sont également validés par l'OMS, et compensés par certaines juridictions (Suède, Ontario, Nouvelle-Écosse). Les effets biologiques et sanitaires des émissions électromagnétiques sont un sujet problématique, en présence de données probantes contradictoires et publique, et de processus de recherche fortement biaisés par l'origine du financement. Dans ce contexte, le règlement à l'étude manque nettement de capacité d'appréhension et de prévention des problèmes de santé, vu la complexité des conditions d'exposition en milieu urbain saturé de signaux divers. Sa méthode et son alignement aux institutions mises en cause à l'échelle internationale construisent des lacunes éthiques importantes, celles de la publicité et de l'incapacité de précaution sanitaire. Ces lacunes se retrouvent dans le produit principal du règlement, l'ajustement paysager des antennes. Une réponse appropriée au contexte fortement problématique de la recherche et de la protection personnelle commande l'observation du principe de précaution, l'éducation populaire et l'ajustement aux rapports sociaux de la production réglementaire.

Les effets biologiques et sanitaires des émissions électromagnétiques : une abondance de données problématique

Il se trouve des centaines d'études scientifiques montrant que les radiofréquences produisent des effets biologiques et de santé à des niveaux sub-thermiques, c'est-à-dire à des niveaux inférieurs à ceux produisant l'échauffement des tissus. Cela, pour plusieurs catégories d'émetteurs, notamment radiohoniques, télévisuels, de téléphonie ou de détection (radar). Sur la base des effets thermiques, l'ICNIRP établit des recommandations d'exposition actuellement adoptés par les agences de santé comme Santé-Canada. Selon HESE-UK (annexe), les émissions électro-magnétiques affectent les processus biologiques et physiologiques à des seuils quelques 90 milliards de fois inférieurs à ceux prescrits par l'ICNIRP pour les signaux cellulaires 1800MHz communs, soit 900 microwatts par cm2. Pourtant, les téléphones cellulaires seraient fonctionnels à des puissances près de 4500 milliards de fois inférieurs à ce seuil, soit à 2E-9 microwatt par cm2.

Dans l'état actuel de la réglementation, seuls les effets thermiques sont réputés biologiquement actif, et délétères sur la santé; cette conclusion semble retenue par l'INSPQ (2010 : 13, 25):

> ''Concernant les effets rapportés par certaines études dans les bandes de 100 kHz à

300 GHz, à des niveaux de RF inférieurs au seuil de manifestation des effets thermiques, Santé Canada souligne : « À l'heure actuelle, ces effets n'ont pas été scientifiquement établis, et leur incidence sur la santé humaine n'est pas suffisamment comprise. En outre, le manque de preuves de causalité, de vraisemblance biologique et de reproductibilité affaiblit grandement l'hypothèse de l'existence de tels effets. » (SC, 2009b)''

''Pour protéger la santé de la population quant aux émissions
de RF issus des antennes relais, la plupart des pays se basent sur les limites d'exposition proposées par l'ICNIRP ou l'IEEE et il en est de même au Canada. Selon ces organisations, ces limites sont établies en fonction du poids de la preuve scientifique, basées sur les risques d'effets aigus sur la santé. Aucune limite n'a été retenue par ces organisations quant au risque associé à l'exposition chronique, les données scientifiques ne permettant pas d'appuyer de telles recommandations. Il a été jugé néanmoins nécessaire de poursuivre la réalisation d'études approfondies sur la question et de reproduire les études où des effets ont été rapportés''.

Toujours selon l'INSPQ,

''Plusieurs groupes d'experts indépendants mandatés par des organismes nationaux et internationaux se sont penchés sur les effets des RF. Les avis de ces groupes sont majoritairement concordants et peuvent être résumés comme suit : compte tenu des connaissances actuelles et des faibles niveaux d'exposition aux RF issus des stations de base, la probabilité d'un risque sur la santé de la population générale et celle vivant à leur proximité peut être considérée faible ou inexistante'' (2010 : 25).

Cette concordance est démentie par plusieurs juridictions européennes dont Conseil d'État français et le Conseil de l'Europe, faisant état de plus de 2000 (deux-miles) études établissant des effets biologiques et sanitaires des émissions électromagnétiques, à des niveaux sub-thermiques (Doc. 12608, 2011: 10). Plusieurs organisations expertes citoyennes ont constitué des recueils colligeant des centaines d'études scientifiques révisées par des pairs (Pubmed, etc), à la fois épidémiologiques, inVitro et cliniques s'intéressant à différentes formes d'exposition électromagnétique. C'est le cas des organisation Emfacts, HESE-UK, 001.be en annexe. Une majorité de ces études, dont le résumé est disponible, montrent des effets à différentes classes d'exposition, allant du courant domestique aux antennes de télévision, en passant par les mâts cellulaires. Leur lecture est rapide et fortement recommandée.

Dans son rapport, l'INSPQ s'en remet aux conclusion d'experts étatiques pour soutenir que les effets biologiques, notamment génotoxique, cancérigène, de stress cellulaire, immunitaire et nerveux (sommeil, attention, cognition, etc) ''n'ont pu être confirmés'', et que l'exposition à des niveaux aux radio-fréquences à des niveaux sub-thermiques ne les entraine pas (2010: 14). Des rapports importants, dont l'un considéré par l'INSPQ affirment tout le contraire. L'énumération de ces effets par l'INSPQ forme incidemment le titre des chapitres du rapport du Bioinitiative Working Group (2007). Cette revue de littérature, bien que combinant les conclusions de recherche clinique, biologique et documentaire, fait état de façon très détaillée de ces effets, et du mécanisme d'interaction entre la cellule, le système humains et les émission électromagnétiques. La

documentation de ces effets et mécanismes est l'objet de deux autres importants rapports, non pris en compte par l'INSPQ. L'un étant l'*International Commisision for Electromagnetic Safety* et l'autre, le *Competence Initiative for the Protection of Humanity*, (en annexe). Comme citoyen, je n'ai pu lire que quelques tomes du Bioinitiative, en plus de nombreux articles; mais le régulateur ne peut faire l'économie de ces articles et rapports. Je souhaite que les commissaires en citent des extraits, en voici un, sur l'esprit du rapport.

> ''Today's public exposure limits are based on the presumption that heating is the only concern when living organisms are exposed to RF and ELF. These exposures can create tissue heating that is well known to be harmful in even very short-term doses. As such, thermal limits do serve a purpose. For example, for people whose occupations require them to work around electrical power lines or heat-sealers, or for people who install and service wireless antenna towers; thermally-based limits are necessary to prevent damage from heating (or, in the case of ELF - from induced currents in tissues). In the past, scientists and engineers developed exposure standards for electromagnetic radiation based what we now believe are faulty assumptions that the right way to measure how much non-ionizing energy humans can tolerate (how much exposure) without harm is to measure only the heating of tissue (for – induced currents in the body). In the last few decades, it has been established beyond any reasonable doubt that bioeffects and some adverse health effects occur at far lower levels of RF and exposure where no heating occurs at all; some effects are shown to occur at several hundred thousand times below the existing public safety limits where heating is an impossibility. Effects occur at non-thermal or low-intensity exposure levels far below the levels that federal agencies say should keep the public safe. For many new devices operating with wireless technologies, the devices are exempt from any regulatory standards. The existing standards have been proven to be inadequate to control against harm from low-intensity, chronic exposures, based on any reasonable, independent assessment of the scientific literature. It means that an entirely new basis (a biological basis) for new exposure standards is needed.
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> Citant Adey:
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> *There are major unanswered questions about possible health risks that may arise from human exposures to various man-made electromagnetic fields where these exposures are intermittent, recurrent, and may extend over a significant portion of the lifetime of an individual. Current equilibrium thermodynamic models fail to explain an impressive spectrum of observed bioeffects at non-thermal exposure levels."*
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> *Bioinitative report, 2010, section 2: 4,5*

> *Markova et al. (2005) reported that non-thermal microwave exposure from Global* System for Mobile Communication (GSM) mobile telephones at lower levels than the ICNIRP safety standards affect 53BP1 and γ-H2AX foci and chromatin conformation in human lymphocytes. They investigated effects of microwave radiation of GSM at different carrier frequencies on human lymphocytes from healthy persons and from persons reporting hypersensitivity to electromagnetic fields (EMFs). They measured the changes in chromatin conformation, which are indicative of stress response and genotoxic effects, by the method of anomalous viscosity time dependence, and analyzed tumor suppressor p53-binding protein 1 (53BP1) and phosphorylated histone

> H2AX (γ-H2AX), which have been shown to colocalize in distinct foci with DNA double-strand breaks (DSBs), using immunofluorescence confocal laser microscopy. The authors reported that microwave exposure from GSM mobile telephones affect chromatin conformation and 53BP1/γ-H2AX foci similar to heat shock. For the first time, they reported that effects of microwave radiation from mobile telephones on human lymphocytes are dependent on carrier frequency. On average, the same response was observed in lymphocytes from hypersensitive and healthy subjects. These effects occurred at non-thermal microwave exposure levels from mobile telephones. These levels are presently permissible under safety standards of the International Commission for Non-Ionizing Radiation Protection (ICNIRP).
> (... et ainsi de suite; Bioinitiative Report, 2010 section 8: 12).

Outre les rapports Bioinitiative (2007), ICEMS (2010), CIPH (2009) et de Commission Européenne (2010), Plusieurs coalitions de médecins et de scientifiques font appel public pour dénoncer l'inadéquation biologique des normes de l'ICNIRP sur lesquelles s'appuient le Canada. Ceux-ci réclament leur révision et la production de normes d'exposition biocompatibles. Ces appels, notamment de Fribourg, de Bénévento et du Syndicat de médecine générale de France incitent à la précaution. Dans ce contexte problématique, le Conseil d'état français, et la Commission Européenne ont tous deux adoptées en 2010 des résolutions appliquant désormais le principe de précaution face au déploiement d'antennes de télécommunication. En Europe, exposée depuis plus longtemps que nous aux radiofréquences, l'érection d'antennes est une préoccupation sanitaire d'ordre public de premier plan (et non une somme de problèmes individuels référés à la psychiatrie). Plusieurs villes ordonnent l'enlèvement d'antennes et abaissent systématiquement les puissances à des seuils biocompabibles,sur l'ensemble de leur territoire. Cela, bien que l'établissement de seuils est toujours l'objet d'un litige scientifique, même à des niveaux sub-thermique d'exposition.

Le biais en recherche

Il importe de traiter du biais en recherche, puisque les programmes de recherche au sein d'organisations de références telles que l'OMS et l'ICNIRP, se révèlent soumis à l'influence de l'industrie des télécommunication. Une importante étude conduite par l'excellente et démocratique revue Environmental Health Perspective (115:1–4 (2007) en annexe) révèle un biais de financement important, ainsi qu'un biais de publication (retenue) appréciable des résultats :

> ''*None of 31 journals published a statement on* possible conflicts of interest of the 287 authors listed in the bylines (...) *Studies funded exclusively by industry reported on the largest number of outcomes but were less likely to report statistically significant results: The OR for reporting at least one such result was 0.11 (95% CI, 0.02–0.78), compared with studies funded by public agencies or charities*' (...) Forty (68%) studies reported one or more statistically significant results ($p < 0.05$) indicating an effect of the exposure (...) Thirty-seven (63%) studies had a neutral title, 11 (19%) a title reporting an effect, and 11 (19%) a title reporting no effect.

Ce dernier extrait fait état tant d'un biais de financement que de publication. Au sein de l'OMS, Michael Repacholi coordonna le ''Projet CEM'' chargé de coordonner la recherche dans plusieurs pays. Il est accusé par un large éventail de journalistes d'avoir systématiquement servi l'industrie des

télécommunication. Un document annexe préparé David Leloup, journaliste au Corporate Europe Observatory publié par Robin des toits (26 Janvier 2007) fait témoigner ces journalistes : ''*Au total, il s'avère que l'industrie du mobile a financé, à elle seule, plus de 40% du budget du projet CEM de l'année fiscale 2005-2006 - lequel s'élevait à 725.000 $. Cette proportion de financement industriel ne tient évidemment pas compte du possible soutien financier de l'industrie électrique*''. Une autre recherche journalistique (28 références) affirme similiairement que :

> As reported by the New York based publication, *Microwave News* On October 1, 2005, the 20 member WHO Task Group writing a new Environmental Health Criteria (EHC) document on power frequency EMFs included, at the request of Repacholi, repre-sentatives from the electrical utilities, or organisations with close ties with the industry. Their task was to both assist in writing the initial draft and review the completed draft.[7] This is in clear conflict with what Repacholi stated in his testimony in the May 2001 Australian Senate Inquiry hearings (...)
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> When Repacholi sent a draft of the EHC out for review in early July 2005, the reviewers included representatives from the power industry bodies: The Federation of Electric Power Companies of Japan, Pacificorp (USA), Hydro-Quebec (Canada), the Utility Health Sciences Group (USA) and Exponent Inc (USA) (...)
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> In addition to WHO staff, the only other observers that Repacholi invited to the WHO Task Group meeting in Geneva on 3 October to recommend exposure limits, were eight representatives from the power industry. Members of the press were barred from attending.[11] In addition the meeting was not publicised on either the WHO web site meetings list or the Bioelectromagnetics Society Newsletterʾs conference calendar and very few members of the EMF scientific community, including important EMF epidemiologists, were even aware of the meeting.[12] Only industry representatives received invitations.
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> Journal of the Australasian College of Nutritional & Environmental Medicine (April 2006)

Ce même document fait état d'un jeu de chassé-croisés entre 20 personnes à la direction du Projet CEM de l'OMS et de l'ICNIRP. Sans m'étendre sur les formes particulières du biais de financement et de sélection, je dois attirer l'attention sur sa prise en compte déterminante par la Commission Européenne :

> ''On se doit de constater que la problématique des champs ou ondes électromagnétiques et ses conséquences possibles sur l'environnement et la santé est comparable à celle d'autres problèmes actuels, notamment celui de l'autorisation de la mise sur le marché des produits chimiques, des pesticides, des métaux lourds, des OGM, pour ne citer que les plus connus. Une des causes de l'inquiétude des populations et de leur méfiance vis-à-vis de la communication par les agences de sécurité officielles et par les gouvernements réside certainement dans le fait que par le passé, un certain nombre d'affaires ou de scandales sanitaires comme celui de l'amiante, du sang contaminé, des PCB ou dioxines, du plomb, du tabagisme et récemment encore celui de la grippe H1N1 ont pu avoir lieu malgré le travail ou même avec la complicité d'agences nationales ou internationales dites de sécurité environnementale ou sanitaire.
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> 28. *C'est d'ailleurs dans ce contexte que la commission de l'environnement, de l'agriculture et des questions territoriales travaille actuellement sur la question des conflits d'intérêts et de la nécessité urgente d'une véritable indépendance des scientifiques engagés dans les agences officielles ayant comme*

mission d'évaluer les risques des produits avant leur autorisation de mise sur le marché.

29. Le rapporteur souligne dans ce contexte qu'*il est pour le moins très curieux de constater que les valeurs-seuil officielles en vigueur pour limiter l'impact sanitaire de champs électromagnétiques de très basse fréquence et des ondes de haute fréquence avaient été formulées et proposées aux institutions politiques internationales (Organisation mondiale de la Sante, Commission européenne, gouvernements) par l'ICNIRP, ONG à origine et à structure peu transparente soupçonnée d'ailleurs de liens assez proches avec les industries dont l'essor dépend des recommandations de valeurs-seuil maximales pour les différentes fréquences des champs électromagnétique*s.

30. *La simple reprise et l'adoption des recommandations de sécurité préconisées par l'ICNIRP par la plupart des gouvernements et par les agences de sécurité* semble s'être faite essentiellement pour deux raisons:
– pour ne pas entraver l'essor de ces nouvelles technologies promettant la croissance économique, le progrès technologique et la création d'emplois;
– mais également parce que les décideurs politiques restent malheureusement peu impliqués dans les questions d'évaluation des risques technologiques sur l'environnement et la santé.

31. Concernant les résultats souvent non concluants ou même contradictoires de recherches et d'études scientifiques sur les risques éventuels de produits, de médicaments ou comme ici de champs électromagnétiques, *un certain nombre d'études comparatives semblent d'ailleurs indiquer une relation assez forte entre l'origine des financements, privés ou publics, et les résultats de l'évaluation des risques, situation évidemment inacceptable puisque révélatrice de conflits d'intérêts mettant en cause l'intégrité, l'indépendance et l'objectivité de la recherche scientifique.*

32. Ainsi par exemple, dans le domaine de l'évaluation du risque induit par les radiofréquences des téléphones portables sur la santé, des chercheurs suisses de l'Université de Berne ont présenté en 2006 les résultats d'une analyse systématique de l'ensemble des résultats des recherches effectuées et ont conclu à une forte corrélation entre le mode de financement des recherches et les résultats obtenus: 33% des études financées par les industriels concluent à l'existence d'effets sur notre organisme de l'exposition aux radiofréquences de la téléphonie mobile. Ce chiffre s'élève à plus de 80% lorsque les études sont financées par des fonds publics.

33. *Il faut donc, dans ce domaine comme dans d'autres, plaider pour une véritable indépendance des agences d'expertise et en faveur d'une expertise indépendante, pluridisciplinaire et contradictoire*. Il ne doit plus être possible que des donneurs d'alerte soient discriminés et que des scientifiques critiques mais reconnus soient exclus dans le choix des experts siégeant dans les comités d'expertise ou que leurs recherches ne reçoivent plus de moyens financiers''

(CE, 2010, Document 12608, section B, pp 8,9).

Le règlement à l'étude : un règlement insuffisant d'un point de vue sanitaire, dans un contexte problématique

Devant un tel faisceau de données et l'incrimination aussi sérieuse des programmes de recherche, les prémisses du règlement à l'étude se montre totalement inadéquates. En conséquence, le règlement se montre insuffisant pour protéger la santé, et scientifiquement impertinent. Il ne pose aucune

question visant à (laisser) comprendre explicitement les effets sanitaires des émissions provenant des antennes de télécommunication, et ne pose aucune condition claire visant à les prévenir. Il ne définit aucun critère s'adressant aux classes d'antennes et d'émission (radio, télé, cellulaire, etc), aucun critère visant à saisir la propagation des émissions et l'effet de leur cumul dans un contexte urbain. Il n'aborde pas non plus la question des seuils d'exposition, malgré l'étendue des conditions d'exposition (puissance, fréquence, genre, temporalité des signaux) où des effets s'avèrent.

Dans l'état actuel de la science, on ne peut ignorer les données publiques portant sur la santé, ni supposer que la santé ne soit en cause sans démontrer une maîtrise des phénomènes liant la biologie humaine à la physique des émissions non-ionisantes dans l'environnement habité. Cette démonstration apparaît d'autant nécessaire puisque qu'un nombre irréfutable d'étude montre des effets biologiques et sanitaire, puisque les données de la science sont fortement contradictoires et entachées de biais tenaces, le plus fort semblant être le biais de financement.

Incidemment, le point réglementaire 5.8.1.2 : '' Le choix de l'emplacement d'un support d'antenne, d'une antenne ou d'un équipement doit minimiser son impact sur un bâtiment ou un secteur sensible comme un secteur résidentiel ou institutionnel (garderie, école, hôpital) situé à proximité; '' témoigne d'une juste préoccupation. Ce point constitue la seule mention du règlement dont la portée puisse s'étendre à la santé. Ce point montre une compréhension insuffisante des effets et des risques de santé posées par les émissions électromagnétiques, comme de la géographie de la propagation des ondes. Il montre l'application scientifiquement et géographiquement hazardeuse d'un principe de précaution insuffisamment formalisé. Le comité ad-hoc du Conseil de la ville de Montréal à l'origine du projet de règlement à l'étude s'étant réuni à quatre reprises, on ne saurait justement s'y attendre.

Notons d'ailleurs qu'entre spécialistes des Services électriques électriques, des Transports, de la Voirie et du Patrimoine, aucun épidémiologiste, aucune biologiste ne siégeaient à ce comité Comité ad-hoc formé le 23 novembre 2010. Il s'agit d'une lacune importante; on peut supposer que de tels spécialistes auraient affirmé la nécessité de réglementer les antennes en connaissance des effets sanitaires afin de les prévenir, et la difficulté de faire faire cela hors d'un cadre problématique.

En ce sens, en plus d'apparaître insuffisant, voire prématuré, le projet de règlement injustement unifié. Il n'offre pas un cadre adéquat pour réglementer l'implantation d'antennes sur le territoire montréalais, ni pour négocier des ententes avec des opérateurs de communication et de diffusion hertzienne.

La production réglementaire dans un contexte problématique et fortement biaisé

Le caractère problématique décrit par la Commission Européenne quant à la probité des données et aux mécanismes concourant à la définition de la recherche scientifique demande un traitement problématique de la production réglementaire. Ce traitement problématique nécessite l'observation du principe de précaution, mais aussi l'éducation populaire en matière de radioprotection, la qualification de la publicité, tout comme la construction de rapports de forces entre différentes institutions, et juridictions.

Le principe de précaution suppose que les effets possibles d'un polluant, montrés dans certaines conditions par certaines convergences scientifiques servent de justification à la soustraction du risque général. Surtout, il demande à ce que la preuve de l'innocuité (en toutes circonstances applicables) soit produite (publiquement) par l'émetteur, ou le producteur du risque. Or, rappelons que cette preuve n'a jamais été établie dans le cas des émissions électromagnétiques. D'ailleurs, rappelle Belyaev (extraits en annexe), les classes de signaux émis par les opérateurs de téléphonie cellulaire n'ont pas été reproduits de façon satisfaisante dans les études scientifiques, qui n'ont d'ailleurs pas fait l'objet d'expériences visant à reproduire les effets des conditions réelles d'exposition:

> ''At present, new situation arose when a significant part of the general population is exposed chronically (much longer than previously investigated durations of exposures (…) Most of the real signals that are in use in mobile communication have not been tested so far. Very little research has been done with real signals and for durations and intermittences of exposure that are relevant to chronic exposures from mobile communication.Most of the real signals that are in use in mobile communication have not been tested so far. Very little research has been done with real signals and for durations and intermittences of exposure that are relevant to chronic exposures from mobile communication. In some studies, the so-called ‘‘mobile communication-like’’ signals were investigated that in fact were different from the real exposures in such important aspects as intensity, carrier frequency, modulation, polarization, duration and intermittence. How relevant such studies to evaluation of adverse health effects from MW of mobile communication is not known''
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> Igor Y Belyaev dans *European Journal of Oncology*, paru dans ICEMS-Ramazzini, pp. 187-218.

Au mieux, trouvons nous dans les rapports de l'AFSSET, d'Industrie-Canada un avis quant à l'absence de causalité avérée hors de tout doute.

Le réglage de la formulation d'hypothèse aux seuls effets thermique a pour conséquence d'escamoter la mise en relation des caractéristiques ''qualitatives'' mais quantifiables des signaux, et celles des structures anatomiques ou moléculaires qui leur sont soumises. Ces signaux pouvant être définis non seulement par leur intensité et leur fréquence, mais aussi par leur modulation, leur intermittence et leur polarisation. Les caractéristiques anatomiques pouvant être définies par leur forme, taille et densité, la complexité et la forme de leurs liens, la temporalité des échanges ioniques, et ainsi de suite.

De nombreux travaux fondamentaux, dont ceux de Johansson, Blackman, Adey et Kundi ont montré que la modulation (pulsation et forme de crête signalée dans le temps) des fréquences transporteuses d'information confère à cette fréquence porteuse des effets différents, suivant la modulation donnée. Tandis que les caractéristiques mêmes des tissus et structures soumis produisent des ''fenêtres d'expositions'', c'est-à-dire qu'on y observe des effets (mytose, apoptose, échanges membranaires, etc), constants sur des plages de puissance s'étendant sur 10^{14} W/m^2 (dix mille milliards de fois inférieur ou supérieur); cela, sur des plages étroites de fréquence, qui rétrécissent non-uniformément lors d'un abaissement des puissances. Ces fenêtres étant d'ailleurs influencées par l'état momentané, notamment la densité en eau d'un tissu. Ces fenêtres pouvant recouvrir les plages d'effets sub-thermiques, mais clairement aussi faibles que $<10^{-21} – 10^{-19}>$ $W/m^2/Hz$. C'est-à-dire dix milliards de fois inférieures à l'intensité des résonnances de Schumann réglant les rythmes

circadiens humains (10^{-10} W/m^2), et associé par Kositsky et coll. au seuil de perception humaine.

D'autre part, il est clair que l'addition des signaux exerce une incidence déterminante sur les effets biologiques et sanitaires. L'effet concurrent des signaux de téléphonie cellulaire et du champ électromagnétique statique (terrestre dont l'intentisé varie selon la structure du bâtiment) est foncièrement différent de celui des signaux téléphoniques seuls (selon Lai); du reste, on observe que les radiofréquences brouillent la fonction régulatrice des ''résonnances de Shumann'' sur le rythme circadien, lorsque ces deux signaux entrent en phase (selon Cherry dans Critique de l'ICNIRP). Ce qui expliquerait en partie que les radiofréquences troublent le sommeil. La suppression de la sécrétion de la mélatonine, fréquemment observée, en expliquerait une autre part.

Cela est dire autant la sensibilité des processus de régulation bio-physique, la complexité et la variabilité des conditions produisant les effets sub-thermiques observés dans un trop grand nombre d'expériences pour être réfutés. La constance des effets moyennant de fortes variations de puissance à l'intérieur de fenêtres d'expositions, relaté par plusieurs chercheurs soulève également des doutes sur la validité simple du modèle toxicologique, ou d'un effet simplement fonction d'une intensité (bien que on observe cette fonction de dose dans certaines conditions).

Le paragraphe ''replication studies'' extrait de Belyaev expose ainsi une part des difficultés à reproduire des résultats de recherches, donc à produire des résultats scientifiques unifiés, même en excluant les biais inextricables. La difficulté d'isoler les groupes-témoins, ainsi que les délai de latence et de carance des effets (variant de quelques heures à quelques semaines) expliqueraient une autre part de la variabilité. En fait, la difficulté de soustraire les groupes-témoins de l'exposition (se rendant au laboratoire dans ou depuis un environnement exposé), autant que les délais de latence et de carence résultent typiquement en une sous-évaluation du risque (selon Cherry et Belyaev en annexe).

La complexité du contrôle des conditions d'exposition en laboratoire, couplée à l'absence quasi complète d'études reproduisant les conditions d'expositions aux signaux réels de communication commande le recours au principe de précaution. Incidemment, il est vraissemblable qu'en raison de la complexité et de la variabilité des conditions d'exposition en milieu urbain (vu le manque d'homogénéité du cadre bâti, la concentration locale des signaux par réflexion, leur addition harmonique, etc), une preuve de l'innocuité suffisamment stable ne puisse jamais être produite.

Soutenons g□□alement qu'une ou plusieurs □udes ''n□atives'' n'annulent pas une □ude positive montrant des effets biologiques ou sanitaires, encore moins la convergence de certaines □udes positives. Ces □udes n□atives ajoutent plut□ □ la somme des connaissances, indiquant les conditions dans lesquels aucun effet n'est observ□. Du reste, de fa□n nuanc□ par Belyaev, l'incertitude clinique commande l'observation des □udes □id□iologiques faisant appel □ l'association de facteurs de risque sur des cohortes importantes plut□ qu'□ la mise □ jour d'un lien de causalit□ universellement constant (telles que Mild, 1998 ou l'□ude REFLEX, etc). L'□ude de Mild, reproduite dans une ''Critique de l'ICNIRP'' (Cherry, en annexe), montre des effets croissants avec la dose... C'est-□-dire avec le produit de l'intensit□ et d'une fr□uence d'exposition, de fa□n cumulative, sur une cohorte de 11 000 utilisateurs de t□□hones cellulaires. Ce qui justifierait d'autant plus le recours □ la pr□aution pour les personnes, affect□s ou non.

Devant un polluant dont il est pratiquement impossible de se soustraire individuellement, le devoir de précaution des autorités se trouve augmenté, sinon posé de façon différente : non seulement a-t-il l'obligation de protéger les usagers-bénéficiaires pouvant ignorer les risques encouru, il a l'obligation de protéger les personnes ne réalisant aucun bénéfice de la pollution d'autrui. Il en découle une double obligation, d'information et de soustraction.

Pour le régulateur, cette exigence place encore une fois la production des règlements dans un procès scientifique en public, et devant l'obligation du principe de précaution. La complexité inextricable du problème place alternativement l'administration publique face au besoin d'innovation : on observe que la naissance de nouvelles classes de signaux (modulations) supplante la capacité de mise à jour des chercheurs. Ainsi, les administration publiques devraient chercher à orienter l'innovation, et prescrire l'utilisation de technologies sûres.

Au lieu d'un simple alignement aux directives d'Industrie Canada, la Ville de Montréal devrait donc (de concert avec la CMM):

Mettre sur pied un comité d'étude permanent sur les effets biologiques et sanitaires des émissions électromagnétiques auquel siégerait à part comparables des universitaires et experts d'État, des représentant d'organisation citoyennes et des élus. Cela, afin de créer des conditions de recherche et de délibération plus libres de conflit d'intérêt, et où l'équilibre des pouvoirs serait mieux accompli. Dans la conduite de ses revues, ce comité accordera une importance prépondérante aux conclusions d'organisation expertes du public et de chercheurs non-affiliés à l'industrie. Les participants non-salariés par leurs organisations affiliées toucheraient une rémunération d'office.

Informer le public des effets biologiques et délétères des émissions électromagnétiques observés, dans les conditions où ces effets sont observés. Obliger les opérateurs et installateurs d'antennes à le faire. Cela, dans un effort de vulgarisation mobilisant épidémiologues, biologistes et cliniciens face à un problème à rendre transparent. Cette information devrait porter sur les émetteurs commerciaux, domestiques et personnels (wifi, téléphone sans fil domestique, blueTooth, etc).

Soutenir le développement des technologies de diffusion de l'information qui soient sûres comme la fibre optique et le câble coaxial, l'usage des fréquences lumineuses ou infrarouges pour la diffusion sans-fil. Cela, par un programme de développement industriel : il est probable que les émissions électromagnétiques deviennent une préoccupation d'ordre public éminente, comme elle l'est maintenant en Europe. Agir sans délai donne une occasion d'affaire exceptionnelle, en plus d'une utilité sociale plus grande que l'industrie du jeu vidéo, par exemple. La Ville de Montréal, de concert avec la CMM devrait assurer un plus grand déploiement des téléphones publics filaires; similairement, inciter au développement de bornes publiques et d'appareils personnels non-émetteurs-récepteurs pouvant être couplés et dialoguer. Il se cache ici un marché potentiel gigantesque.

De concert avec la CMM, revendiquer auprès des élus et d'Industrie-Canada l'obtention d'un pouvoir conjoint de réglementation en fait d'intensité d'exposition et de types d'émissions (fréquence, modulation) autorisés. Revendiquer également le pouvoir de réglementer l'installation et l'usage des catégories d'émetteurs échappant à la réglementation des institutions canadiennes. Tenir un registre des émetteurs non-enregistrés par Industrie-Canada, comprenant les émetteurs domestiques.

Par précaution et réalisme politique, inciter les opérateurs à abaisser volontairement les puissances d'émission des émetteurs actuels; demander aux requérants d'un permis d'émission la production de la preuve d'innocuité (un devoir de recherche devant Industrie-Canada).

Régir strictement, par zone, l'érection et l'installation des antennes de communication. Cela puisque la loi permet aux municipalité de le faire en définissant géographiquement la localisation et la taille (l'échelle) des zones permissives. Cela, en appliquant le principe de précaution, chargeant la preuve d'innocuité aux opérateurs d'antennes.

De concert avec la Communauté métropolitaine de Montréal, élaborer un chapitre de planification visant à créer une ou plusieurs zones libres d'émissions électro-magnétiques intentionnelles, et à faible émissions parasites. Cela, dans une perspective préventive, autant que curative. L'ébauche de ce chapitre devrait être incorporé au Plan de développement métropolitain en cours de production.

L'établissement de cette ou de ces zones devrait répondre à deux types de critères :

a) géographique : suffisamment étendue pour soustraire à long terme de toute classe d'émission intentionnelle, terrestre ou satellitaire; permettant aux personnes affectées par les rayonnements de conduire une vie productive, par l'accès à la transmission informationnelle par câble, et à la ville-centre par transport public de masse (train de banlieue, SLR). Soustrayant également au transport des aérosols, puisque certaines classes de contaminants moléculaires [notamment mercure et manganèse des combustibles fossiles] sont réputés augmenter la susceptibilité électromagnétique (Sears, Commission Canadienne des droits de la personne, 2007). Donc en amont des villes par le sens du vent dominant.

b) Urbanistique: définir des critères souples accommodant l'expérimentation technique et l'économie esthétique sur l'habitat, à des fins de soustraction aux émissions électro-magnétiques et d'autres polluants environnementaux. Cela d'une part, puisque peu de techniques formalisées et abordables d'adaptation de l'habitat aux susceptibilités environnementales existent. Cette adaptation requiert typiquement des patrons d'implantation répondant intimement à la topographie et aux patrons de diffusion des polluants; l'installation d'équipements de protection (écrans, filtres); une volumétrie, ainsi que des caractéristiques hygiéniques (détachement, électrification) exceptionnelles.

D'autre part, il semble que la susceptibilité électro-magnétique ou environnementale-multiple soit handicapante à divers degré; les personnes atteintes perdent souvent leur revenu et nécessitent un habitat abordable, d'où elles chercheront parfois à travailler. Proposons aussi que la soustraction des contaminants est une valeur sûre, alors la diversité et l'ambiguïté urbanistique diversifiera le prix de l'habitat.

Le traitement paysager des antennes : une question de publicité

Comme en témoigne le règlement à l'étude, le traitement paysager des antennes est important, bien que la santé publique me semble une préoccupation prépondérante. À ce titre, je crois qu'il convient de préserver les valeurs paysagères en agissant sur la localisation des antennes, mais de publiciser

leur déploiement : les antennes forment une nuisance problématique qui opposent les intérêts de leurs usagers à ceux des personnes non-usagères. Le problème tient au manque de consensus sur l'innocuité, à la crédibilité des institutions régulatrices autant qu'à l'absence de perception sensorielle immédiate de l'antenne, de capacité de précaution personnelle pour la grande majorité des gens. Il serait donc malhonnête et litigieux de dissimuler les antennes de la (re)connaissance du public. Leur présence sur les domaines public et privé doit donc demeurer et devenir visible; celles-ci doivent d'ailleurs apparaître sous l'apparence d'une composante d'un système de télécommunication.

Ainsi, lorsque des aménagement physiques, privés ou publics visent à dissimuler une antenne pour des raisons esthétiques, une affiche ou un identifiant visible du public devrait être apposée le plus près possible de l'antenne, indiquant clairement qu'il s'agit d'une antenne, sa localisation précise (coordonnées et adresse), sa nature (classe), la puissance, la fréquence, la modulation, l'orientation de ses émissions. La durée et la période des transmissions devraient être également indiquées, ou un identifiant à l'affiche devrait renvoyer à un registre les indiquant. Cette obligation de divulgation pourrait s'étendre aux émetteurs domestiques, du moins en secteurs désignés.

Documents présentés initialement en annexe :

Répertoires de résultats de recherche scientifique :

Electro-Magnetic Fields & Health : Over 900 Published Independant Scientific Studies (Emfacts Consultancy)
http://www.emfacts.com/

Power Density: Radio frequency Non-Ionizing Radiation (HESE-UK)
www.hese-project.org/hese-uk/en/niemr/power_density_effects.pdf

0*01*be - références - 346 publications scientifiques par ordre chronologique (URL):
http://home.scarlet.be/~tsf94646/001/sources.htm

EMF Portal - Search for publications
http://www.emf-portal.de/suche.php?l=e

Revues de littérature scientifique :

Rapport du Bioinitiative Working Group (2007)
http://www.bioinitiative.org/

Non-Thermal Effects and Mechanisms of Interaction Between Electromagnetic Fields and Living Matter (ICEMS-Ramazzini, 2010 part One and Two) (télécharger le rapport depuis Buergerwelle si le

lien ICEMS est rompu)
http://electromagnetichealth.org/electromagnetic-health-blog/icems/
http://www.buergerwelle.de:8080/helma/twoday/bwnews/stories/1859/

How Susceptible are Genes to Mobile Phone Radiations? (*Competence Initiative for the Protection of Humanity, 2009)*
http://www.icems.eu/docs/howsusceptiblearegenes.pdf

Rapport de la démarche préparatoire à l'adoption de l'Assemblée parlementaire du Conseil de l'Europe (CE, 2010, Document 12608) :
http://assembly.coe.int/mainf.asp?Link=/documents/workingdocs/doc11/fdoc12608.htm

Appels et résolutions :

Résolution de Bénévento:
http://www.icems.eu/resolution.htm

Appel de Fribourg :
http://www.priartem.fr/Appel-de-Fribourg.html

Syndicat de médecine générale (France) :
http://www.smg-pratiques.info/Principe-de-precaution.html

Le biais en recherche :

Environment Health Perspective : *Source of Funding and Results of Studies of Health Effects of Mobile Phone Use: Systematic Review of Experimental Studies*
http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.9149

Conflict of Interest and Bias in Health Advisory Committees; *A case study of industry influence on the WHO EMF Task Group*. JACNEM, Vol. 25 No. 1, pages 15-17, April 2006
http://www.emfacts.com/download/who_conflict.pdf

Téléphonie mobile : trafic d'influence à l'OMS ? - David Leloup
http://www.robindestoits.org/Telephonie-mobile-trafic-d-influence-a-l-OMS_a311.html

Silencing inconvenient research in Sweden; *The death of the No-Risk and Healthy Office projects*, JACNEM Vol. 29, No. 2, Sept. 2010 (corrected copy), with Olle Johansson

http://www.emfacts.com/download/no_risk_Feb_7.pdf

Expertise digne de mention, parmi tant d'autres, sans qu'il en fut question **:**

Celle de Dr Neil Cherry (noter l'□ndue exceptionnelle des r□□ences appuyant les revues de Cherry) ; chercher notamment ''CRITICISM OF THE HEALTH ASSESSMENT IN THE ICNIRP GUIDELINES FOR RADIOFREQUENCY AND MICROWAVE RADIATION (100 kHz - 300 GHz)'' à ce recueil de publications :
http://www.neilcherry.com/documents.php#biological

Celle de la Dr Magda Havas; notamment sur les radiofréquences :
http://www.magdahavas.org/wordpress/wp-content/uploads/2009/10/05_HavasNCRFRTV.pdf
voir aussi : http://www.magdahavas.com/

Celle de Alasdair et Jean Philips de l'organisation Powerwatch : atteindre ''Radiofrequency EMFs and Health'' et ''Phones and Masts'' du Article Library de l'organisation (abonnement gratuit demandé) :
http://www.powerwatch.org.uk/library/index.asp

Celle de Louis Slesin, de l'organisation Microwave News :
http://www.microwavenews.com/

Celle de Daniel Oberhausen, d□□u□ scientifique de l'organisation Priartem:
http://www.priartem.fr/Intrviews-de-Daniel-Oberhausen.html

Celle de Dr. Georges Carlo, premier scientifique américain à valider (pour le compte des opérateurs) la dangerosité de la téléphonie cellulaire:
http://www.whale.to/b/carlo_h.html

Organisations d'intérêt :

Centre de recherches et d'information indépendantes sur les rayonnements électromagnétiques (CRIIREM)

http://www.criirem.org/

Pour une réglementation de l'implantation des antennes relais de téléphonie mobile (PRIARTEM) - information scientifique

http://www.priartem.fr/+-Information-scientifique-+.html

Human ecological, social, environmental Project (HESE)

http://www.hese-project.org/hese-uk/en/niemr/index.php

The Swedish Association for the ElectroHyperSensitive

http://www.feb.se/index_int.htm

Mast Sanity : primary national organisation opposing the insensitive siting of mobile phone and Tetra masts in the UK : http://www.mastsanity.org/

Burgerwelle - Science

http://www.buergerwelle.de/cms/content/view/67/80/

Fondation Santé et Radiofréquences

http://www.sante-radiofrequences.org/

emFacts - epidemiology Index - Research into the health effect of cellphones

http://electricwords.emfacts.com/index-epi.html

00.1.be :

http://home.scarlet.be/~tsf94646/001/index.htm

Teslabel Coordination

http://www.teslabel.be/

Citizens for safe technology - Empowering the public to protect children and nature from...

http://www.citizensforsafetechnology.org/about-cst,1,0

Tout le texte suivant, celui des annexes, est fait d'extraits cités. Ces citations ont pour but d'alléger l'analyse en proposant des plages importantes des rapports ICEMS-Ramazzini et Bioinitiative, et d'autres revues de littérature. Les liens URL indiqués au mémoire donnent accès aux documents originaux. Leur lecture y sera sans doute plus facile. Aussi, je regrette ne pas avoir eu le temps de faire cette sélection à travers tous les documents cités au mémoire (notamment Sears de la Commission canadienne des droits de la personne). Vous pouvez passer d'une annexe à l'autre en cherchant ''Annexe'' dans la page; elle en contient neuf. *Merci.*

Annexe 1 : extraits d'une revue de littérature par Belyaev; l'annexe 1 sert d'abord de référence montrant comment appréhender les effets biologiques et sanitaires non-thermiques des champs électromagnétiques et des radio-fréquences. La revue dont les extraits sont tirées est un chapitre du rapport ICEMS-Ramazzani.

Dependence of non-thermal biological effects of microwaves on physical and biological variables: implications for reproducibility and safety standards

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Abstract
Diverse biological responses, including adverse health effects, to non-thermal (NT) microwaves (MW) have been described by many research groups all over the world. The aim of this paper is to provide an overview of the complex dependence of these effects on various physical and biological parameters, which must be controlled in replication studies.
Besides well-known dependencies on carrier frequency and modulation, emerging data suggest dependencies of NT MW effects on polarization, intermittence and coherence time of exposure, static magnetic field, electromagnetic stray fields, genotype, gender, physiological and individual traits, cell density during exposure. Data also indicate that duration of exposure may be as important as power density (PD) and specific absorption rate (SAR). Further evaluation of these dependencies are needed for understanding the mechanisms by which NT MW affect biological systems, planning *in vivo* and epidemiological studies, developing medical treatments, setting safety standards, and minimizing the adverse effects of MW from mobile communication.

Introduction

Exposures to non-ionizing electromagnetic fields vary in many parameters: power (specific absorption rate, incident power density), wavelength/frequency, near field/far field, polarization (linear, circular), continues wave (CW) and pulsed fields (that include variables such as pulse repetition rate, pulse width or duty cycle, pulse shape, pulse to average power, etc.), modulation (amplitude, frequency, phase, complex), static magnetic field (SMF) and electromagnetic stray fields at the place of exposure, overall

duration and intermittence of exposure (continuous, interrupted), acute and chronic exposures.With increased absorption of energy, so-called thermal effects of microwaves (MW) are usually observed that deal with MW-induced heating. Specific absorption rate (SAR) or power density (PD) is a main determinate for thermal MW effects. Several other physical parameters of exposure have been reported to be of importance for socalled non-thermal (NT) biological effects, which are induced by MW at intensities well below any measureable heating[1-11]. An important question is how these physical parameters could be taken into account in setting safety standards.

Most often, current safety standards are based on thermal MW effects observed in short-term (acute) exposures. On the other hand, NT MW effects, especially those induced during prolonged (chronic) exposures, are accepted and taken into account for setting the national safety standards in some countries such as Russia[10-12]. It should be noted that, in contrast to the ICNIRP (International Commission for Non-Ionizing Radiation Protection) safety standards[13] which are based on the acute thermal effects of MW, the standards adopted by the Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP) are based on experimental data from chronic (up to 4 month) exposures of animals to MW at various physical parameters including intensity, frequency and modulation, obtained from research performed in the former Soviet Union[10-12].

Since setting the current safety standards, the situation with exposure of the general population to MW has changed significantly. Nowadays, most of the human population is chronically exposed to MWsignals from various sources including mobile phones and base stations. These exposures are characterized by low intensities, varieties and complexities of signals, and long-term durations of exposure that are comparable with a lifespan. So far, the “dose” (accumulated absorbed energy that is measured in radiobiology as the dose rate multiplied by exposure time) is not adopted for the MWexposures and SAR or PD is usually used for guidelines. To what degree SAR/PD can be applied to the nowadays NT MW chronic exposures is not known and the current state of research demands reevaluation of the safety standards[12].

There are two main approaches to treat numerous data regarding NT MWeffects. The first one is based on the consideration of these effects in dependence on various physical parameters and biological variables as has consistently been described in many experimental studies and will be reviewed in this paper. The second approach is based on neglecting or minimizing the experimentally observed NT MW effects based on the current state of theoretical physical science that is insufficient for comprehensive explanation of the NT MW effects. As a result of such various treatments of the experimental data, the safety standards significantly vary, up to 1000 times, among countries.

The literature on the NT MW effects is very broad. There are four lines of evidence for the NT MW effects: (1) altered cellular responses in laboratory *in vitro* studies and results of chronic exposures *in vivo* studies[3, 11, 14]; (2) results of medical application of NT MW in the former Soviet Union countries[4, 7, 15, 16]; (3) hypersensitivity to electromagnetic fields (EMF); (4) epidemiological studies suggesting increased cancer risks for mobile phone users[17-19].

This paper is not intended to be a comprehensive review of this literature. In this review, we will focus on the studies which evaluate dependence of the NT MW effects on physical parameters and biological variables.

Experimental studies

The first data on the NT effects of MW in so-called millimeter range (wavelength 1-10 mm in vacuum) was obtained by Vilenskaya and co-authors[20] and Devyatkov[21]. Highly resonant effects of ultra-weak MW (near 70 GHz) on the induction of λ-phage were first established by Webb[22], and subsequently corroborated[23]. In these and subsequent studies the observed spectra of MW action were found to have the following common properties: (1) the MW effects were strongly dependent on the frequency (frequency windows), (2) there was an associated power (intensity) threshold below which no effect was observed, and above which the effects of exposure depended only weakly on power over several orders of magnitude (so-called S-shaped or sigmoid dependence), (3) the occurrence of MW effects depended on the duration of exposure, a certain minimum duration of exposure

was necessary for an effect to manifest itself. These important regularities of the NT MW effects have previously been reviewed[2, 7-9, 24-27].

The first investigations of the NT MW effects at lower frequency ranges were performed by Blackman and colleagues[28-30] and Adey and colleagues[31, 32]. These groups found dependence of the NT MW effects on modulation.
Since that time, other groups have confirmed and extended the main findings of these pioneering studies as will be reviewed below.

Frequency dependence and frequency windows

(…) the results of studies with different cell types indicate that narrowing of the resonance window upon decrease in PD is one of the general regularities in cell response to NT MW. This regularity suggests that many coupled oscillators are involved non-linearly in the response of living cells to NT MW as has previously been predicted by Frohlich[44].
Gapeev *et al.* studied effects of MW exposure (frequency range 41.75-42.1 GHz, frequency increment 50 MHz, PD 240 ⌈W/cm^2) on the respiratory burst induced by calcium ionophore A23187 and phorbol ester 12-myristate 13-acetate (PMA) in the peritoneal neutrophils of mice[45, 46]. MW inhibited the respiratory burst. (…)

Based on the extrapolation from the data obtained in the extremely high frequency range (30-300 GHz), the values for half-width of resonances at the frequency range of mobile phones (0.9–2 GHz) were estimated to be 1-10 MHz[40]. Effects of GSM (Global System for Mobile Communication) MWon chromatin conformation and 53BP1 (tumor suppressor p53 binding protein 1)/©-H2AX (phosphorylated H2AX histone) DNA repair foci in human lymphocytes were studied in this frequency range[38-40, 49]. Dependence of these MW effects on carrier frequency was observed[38, 40, 49]. This dependence was replicated in independent experiments with lymphocytes from twenty six healthy and hypersensitive persons[38, 39, 49].
Tkalec and colleagues exposed duckweed (*Lemna minor L.*) to MW at the frequencies of 400, 900, and 1900 MHz[50]. The growth of plants exposed for 2 h to a 23 V/m electric field of 900 MHz significantly decreased in comparison with the control, while an electric field of the same strength but at 400 MHz did not have such effect. A modulated field at 900 MHz strongly inhibited the growth, while at 400 MHz modulation did not influence the growth significantly. (…)

Remondini *et al.* analyzed changes in gene expression in human EA.hy926 endothelial cells using gene microarrays[53]. Cells were exposed to MW (SAR 1.8-2.5 W/kg, 1 h exposure) either at 900-MHz GSM Basic mode or 1800-MHz GSM Basic mode. Exposure to 900 MHz resulted in up-regulation in 22 genes and down-regulation in 10 genes. No significant change in gene expression was observed after exposure to 1800 MHz.

Sigmoid intensity dependences and power windows

It was found by Devyatkov et al. that NT MW effects display sigmoid dependence on intensity above certain intensity thresholds[21]. This type of PD dependence for the MW effects was observed in other studies as previously reviewed[7-9, 24, 25].

The data obtained in experiments with *E coli* cells and rat thymocytes provided new evidence for sigmoid type of PD dependence and suggested that similar to ELF effects, MW effects may be observed within specific “intensity windows”[35, 41, 43, 54]. The most striking example of the sigmoid PD dependence was found at the resonance frequency of 51.755 GHz[35]. When exposing *E. coli* cells at the cell density of $4 \cdot 10^8$ cell/ml, the effect reached saturation at the PD of 10^{-18}-10^{-17}W/cm^2 and did not change up to PD of

10^{-3} W/cm^2.

(…) data suggested that the PD dependence of MW *effect at the specific resonance frequencies might have a threshold comparable with the background level*. Dependence of the MW effect on PD at one of the resonance frequencies, 51.675 GHz, had the shape of "intensity window" in the PD range from 10^{-18} to 10^{-8} W/cm^2 [41]. It is interesting, that *no MW effect at this resonance frequency was observed at sub-thermal and thermal PD*. This type of PD dependence has supported hypothesis about possible rearrangement of the frequency MW spectra action by the MW field[35]. *The position of the PD window varied between different resonance frequencies and depended on cell density during exposure of cells*[41]. *Despite some uncertainty* in the evaluation of PD at the levels below 10^{-7} W/cm^2 in the referred studies *the data indicated that NT MW at the resonance frequencies may result in biological effects at very low intensities comparable with intensities from base stations and other MW sources used in mobile communication*. (...)

Hawkins exposed rats to MW at 1.3 GHz and analyzed BBB permeability by measuring uptake of several neutral polar substances in certain areas of the brain[59]. A single, 20 min exposure, to continuous wave (CW) MW increased the uptake of D-mannitol at average power densities of less than 3 mW/cm^2. Increased permeability was observed both immediately and 4 h after exposure, but not 24 h after exposure. After an initial rise at 0.01 mW/cm^2, the permeability of cerebral vessels to saccharides decreased with increasing microwave power at 1 mW/cm^2. Thus, the effects of MW were observed within the power window of 0.01-0.4 mW/cm^2. Differences in the level of uptake occurred between effects of CW MW and pulsed MW of the same average power. *Microwaves of the same average power but different pulse characteristics also produced different uptake levels*.

These findings on "power windows" for BBB permeability have been subsequently corroborated by the group of Persson and Salford[60, 61]. In their recent *study, the effects of GSM MW on the permeability of the BBB and signs of neuronal damage in rats* were investigated using a real GSM programmable mobile phone in the 900 MHz band[62]. The rats were exposed for 2 h at an SAR of 0.12, 1.2, 12, or 120 mW/kg. Albumin extravasation and also its uptake into neurons increased after 14 d. The occurrence of dark neurons in the rat brains increased later, after 28 d. Both effects were seen already at 0.12 mW/kg with only slight increase, if any, at higher SAR values.

Duration of exposure and time after exposure

Bozhanova with co-authors reported that the effect of cellular synchronization induced by NT MW depended on duration of exposure and PD[63]. The dependence on duration of exposure fitted to exponential function. The important observation was that in order to achieve the same synchronization of cells, the decrease in PD could be compensated by the increase in the duration of exposure.
Kwee and Raskmark analyzed effects of MW at 960 MHz and various SARs, 0.021, 0.21, and 2.1 mW/kg on proliferation of human epithelial amnion cells[64]. These authors reported linear correlations between exposure time to MW at 0.021 and 2.1 mW/kg and the MW-induced changes in cell proliferation albeit no such clear correlation was seen at 0.21 mW/kg.

MW exposure of *E. coli* cells and rat thymocytes at PDs of 10^{-5}-10^{-3} W/cm^2 resulted in significant changes in chromatin conformation if exposure was performed at resonance frequencies during 5-10 min[33, 43, 65]. Decrease in the MW effects due to lowering the PD by orders of magnitude down to 10^{-14}-10^{-17} W/cm^2 was compensated by several-fold increase of exposure time to 20-40 min[57]. At the relatively longer duration of exposure, more than 1 h, the same effect at the lowest PD of 10^{-19} W/cm^2 was observed[57].(...)

The MWeffects on *E. coli* cells depended on the post-exposure time[56-58]. This dependence had an initial phase of increase about 100 min post-exposure followed by a phase, which was close to a plateau, around 100 min. A trend to decrease in effect was observed at longer times up to 300 min[56, 58].

Coherence time

MW exposure of L929 fibroblasts was performed by the group of Litovitz[68]. MW at 915 MHz modulated at 55, 60, or 65 Hz approximately doubled ornithine decarboxylase (ODC) activity after 8 h. Switching the modulation frequency from 55 to 65 Hz at coherence times of 1.0 s or less abolished enhancement, while times of 10 s or longer provided full enhancement. These results suggested that the microwave coherence effects are remarkably similar to those observed previously with extremely low frequency (ELF) magnetic fields by the same authors.

Electromagnetic environment

The effect of a magnetic noise on microwave-induced spatial learning deficit in the rat was investigated by Lai[105]. Rats were exposed to MW (2450 MHz CW, PD 2 mW/cm^2, average whole-body SAR 1.2 W/kg) alone or in combination with noise exposure (60 mG). Microwave-exposed rats had significant deficit in learning. *Exposure to noise alone did not significantly affect the performance of the animals. However, simultaneous exposure to noise significantly attenuated the microwave-induced spatial learning deficit*. The author concluded that simultaneous exposure to a temporally incoherent magnetic field blocks MW-induced spatial learning and memory deficits in the rat[105]

Lai and Singh studied combined effects of a temporally incoherent magnetic noise (45 mG) and MW (CW 2450 MHz, PD 1 mW/cm^2, average whole-body SAR of 0.6 W/kg) in rat brain cells[106]. MW exposure induced significant DNA breakages as measured with both neutral and alkaline comet assays. *Exposure to noise alone did not significantly affect cells. However, simultaneous noise exposure blocked the MW-induced effects*.

Yao and colleagues investigated the influence of the GSM-like MW at 1.8 GHz on DNA damage and intracellular reactive oxygen species (ROS) formation in human lens epithelial cells (hLECs)[107]. DNA damage examined by alkaline comet assay was significantly increased after 3 W/kg and 4 W/kg radiation, whereas the double-strand breaks (DSB) evaluated by ©-H2AX foci were significantly increased only after 4 W/kg radiation. Significantly elevated intracellular ROS levels were detected in the 3-W/kg and 4-W/kg groups. After exposure to 4 W/kg for 24 hours, hLECs exhibited significant G_0/G_1 arrest. All the effects were blocked when the MW exposure was superposed with a 2 μT electromagnetic noise. The authors concluded that superposed electromagnetic noise blocks MW-induced DNA damage, ROS formation, and cell cycle arrest.
We have previously reported that resonance effects of MW on *E. coli* cell depend on the magnitude of static magnetic field at the place of MW exposure[57]. This dependence was explained by the model of electron-conformational interactions that also predicted possible shift of resonance frequencies in dependence on SMF[35]. More recently, Ushakov with co-authors exposed *E. coli* cells to MW at the PD of 10^{-10} W/cm^2 and the frequencies of 51.675, 51.755 and 51.835 GHz[88]. In this study, cells were exposed to MW at various values of SMF: 22, 49, 61, or 90 ⌈T. *The authors observed that the effects of MW exposure on the conformation of nucleoids depended on the SMF [static magnetic field] during exposure*.

Summary of experimental studies

Numerous experimental data have provided strong evidence for NT MW effects and have also indicated several regularities in appearance of these effects: dependence on frequency within specific frequency windows of "resonance-type"; narrowing of the frequency windows with decreasing intensity; dependence on modulation and polarization; sigmoid dependence on intensity within specific intensity windows including super-low PD comparable to intensities from base stations; thresholds in intensity and exposure time (coherence time); dependence on duration of exposure and post-exposure time; dependence on cell density that suggests cell-to-cell interaction during response to NT MW; dependence on physiological conditions during exposure, such as stage of cell growth, concentration of oxygen and divalent ions, activity of radicals; dependence on genotype; cell-type and cell-line dependence; gender-, age- and individual differences; and SMF and EMF stray field during exposure may be of importance for the effects of NT MW.

Replication studies

Obviously, not taking into account the dependences of NT MW effects on a number of physical parameters and biological variables may result in misleading conclusions regarding the reproducibility of these effects. Especially important might be the observations that NT MW could inhibit or stimulate the same functions dependent on conditions of exposure[2]. Under different conditions of exposure, MW either increased or decreased the growth rate of yeast cells[8], the radiation-induced damages in mice[141], the respiratory burst in neutrophils of mice[79], the condensation of nucleoids in *E coli* cells[56, 57] and human lymphocytes[40]. Potentially bi-directional effects of MW should be taken into account in replication studies.

Despite of considerable body of studies with NT MW in biology, only a few studies were performed to replicate the original data on the NT MW effects. It should be noted, that these replications are usually not completely comparable with the original studies because of either missing description of important parameters of exposure or significant differences in these parameters between original study and replication.

One well-known attempt to replicate the results of Grundler was the study by Gos and co-authors[144]. NoMWeffects were observed in this replication study. However, the deviations from the Grundler's protocol might be a simple reason for poor reproducibility.

For example, synchronized cells were used in studies of Grundler. Contrary to the Grundler's original protocol, Gos used exponentially growing cells. If the MW effects in yeast cells are dependent on stage of growth, cell density and intercellular interactions as it has been described for *E. coli* cells[35, 41, 56, 57], no response should be expected in the logarithmic phase of growth. Gos and colleagues used *S. cerevisiae* strain with the auxotrophy mutations for leucine and uracil. Grundler used the wild type strain. It might suggest another cause for the deviations between the data of Grundler and Gos. Despite orientation of SMF in respect to electric and magnetic components ofMWwas the same, the values of SMF were different. The stray ELF field was 120 nT in the study by Gos, that is higher than usually observed background fields, < 50 nT. The spectral characteristics of the background fields, which were described only in the study by Gos, might be also different. In addition, the conditions of cell cultivation might vary between studies; for example, the data on oxygen concentration in media used in both studies are not available.

Amount of already known physical and biological variables that are important for reproducibility of NT MW effects seem to be far beyond the limits of usually controlled parameters in biological experiments. The knowledge of some of these variables is based on consistent findings following from experimental studies of different research groups. Further evaluation of variables that are important for the NT MW effects would benefit from the developing of the physical and molecular biological models for theMWeffects. Most reviews of the experimental studies do not include analysis of various biological variables and physical parameters when comparing the data on NT MWeffects from different studies. As result, misleading conclusion is often made that MW at NT levels produce no "reproducible" effects.

Possible mechanisms

Analyzing theoretically our experimental data on the MW effects at super-low intensities we concluded that these effects should be considered using quantum-mechanical approach[57]. Reanalysis of our data by Binhi resulted to the same conclusion[97]. This is in line with the fundamental quantum-mechanical mechanism that has been suggested by Frohlich[145]. Most probably, the physical mechanisms of the NT MW effects must be based on quantum-mechanical approach and physics of non-equilibrium and nonlinear systems[44, 98, 146-148].

Our data indicated also that chromosomal DNA is a target for interaction with MW[34, 87, 92].

(...)

The function of this major part of genomic DNA became clear given that the whole genomic DNA is responsible for the creation of the natural spectrum of oscillations that is hypothetically a main characteristic of each biological species[109].

The understanding of mechanisms for the NT MW effects is far from comprehensive. Many questions remain to be addressed such as whether resonance effects of MW depend on electromagnetic noise and SMF during exposure.

Urgent needs and further perspectives

At present, new situation arose when a significant part of the general population is exposed chronically (much longer than previously investigated durations of exposures) to NT MW from different types of mobile communication including GSM and UMTS/3G phones and base stations, WLAN (Wireless Local Area Networks), WPAN (Wireless Personal Area Networks such as Bluetooth), DECT (Digital Enhanced (former European) Cordless Telecommunications) wireless phones. It should be anticipated that some part of the human population, such as children, pregnant women and groups of hypersensitive persons could be especially sensitive to the NT MW exposures.

Multiple sources of mobile communication result in chronic exposure of significant part of general population to MW at the non-thermal levels. Therefore, the ICNIRP safety standards, which are based on thermal effects in acute exposures, cannot protect the general population from the chronic exposures to NT MW from mobile communication[13].

Most of the real signals that are in use in mobile communication have not been tested so far. Very little research has been done with real signals and for durations and intermittences of exposure that are relevant to chronic exposures from mobile communication.

In some studies, the so-called “mobile communication-like” signals were investigated that in fact were different from the real exposures in such important aspects as intensity, carrier frequency, modulation, polarization, duration and intermittence. How relevant such studies to evaluation of adverse health effects from MW of mobile communication is not known.

Emerging evidence suggests that the SAR concept, which has been widely adopted for safety standards, may not be useful alone for the evaluation of health risks from MW of mobile communication. How the role of other exposure parameters such as frequency, modulation, polarization, duration, and intermittence of exposure should be taken into account is an urgent question to solve. Solving this question would greatly benefit from the knowledge of the physical mechanisms of the NT MW effects.

So far, most laboratory and epidemiological studies did not control important features of the NT MW effects as described above and therefore, only limited conclusion regarding health effects of MW from mobile communication can be drawn from these studies. It should be noted that one group of epidemiologists with a long-lasting experience in studying relationship between mobile phone usage and cancer risk have consistently been concerned regarding importance of various MW signals and exposure durations[19, 150-152]. The group of Hardell was the first epidemiologic group in attempting to study separately the MW signals from cordless phones, analogue phones and digital

phones. As a rule, analogue phones had the highest association with the cancer risk.
Cordless phones were associated with the risk for brain tumors, acoustic neuroma, andof eukaryotic species and is represented by noncoding repetitive DNA sequences, is not
understood in molecular biology providing a basement for hypotheses such as “junk DNA”. The function of this major part of genomic DNA became clear given that the whole genomic DNA is responsible for the creation of the natural spectrum of oscillations that is hypothetically a main characteristic of each biological species[109].
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T-cell lymphoma stronger or in the same degree as digital and analogue phones despite significantly lower SAR values were produced by cordless phones[17, 19, 151, 152]. It should be also noted that epidemiological data are controversial and methodological differences are a subject of debates between various research groups[17, 153]. However, the approach of Hardell’s group is more valid from the mechanistic point of view and this should be taken into account when comparing with results of other groups that ignore or minimize the complex dependencies of the NT MW effects on several parameters/variables.
The data about the effects of MWat super low intensities and significant role of duration of exposure in these effects along with the data showing that adverse effects of NT MW from GSM/UMTS mobile phones depend on carrier frequency and type of the MW

signal suggest that MW from base-stations/masts can also produce adverse effects at prolonged durations of exposure and encourage the mechanistic *in vitro* studies using real signals from base stations/masts. Further investigations with human primary cells under well controlled conditions of exposure, including all important parameters as described above, are urgently needed to elucidate possible adverse effects ofMWsignals that are currently being used in wireless communication, especially in new technologies such as UMTS mobile telephony.

The dependence of adverse effects of NT MW from GSM/UMTS mobile phones on carrier frequency and type of signal should be taken into account in settings of safety standards and in planning of *in vivo* and epidemiological studies. Of note, the data from epidemiological studies should be treated with care. Indeed, it is almost impossible to select control unexposed groups because the whole population in many countries is exposed to wide range of MW signals from various sources such as mobile phones and base stations/masts of various kinds, WLAN, WPAN, DECT wireless phones and given that duration of exposure (must be at least 10 years for cancer latency period) may be more important for the adverse health effects of NT MW than PD/SAR. From this point of view, current epidemiological studies may be either inconclusive, if results are negative, or may underestimate the hazard of MW exposure, if results are positive.

The joined efforts of scientific groups within national or international programs are needed for mechanistic studies of the NT MW effects. In order to take unto account all necessary physical parameters and biological variables, these programs should involve scientists with long-lasting experience in studying NT MW effects.

Because NTMWaffect not only brain cells, but also blood cells[38-40, 75], skin and fibroblasts[68, 69, 134, 154], stem cells[67, 116, 155], reproductive organs and sperm quality[156-159] the using of hands-free cannot minimize all adverse health effects. Possibilities to minimize the adverse effects of NT MW using various biophysical and biochemical approaches should be studied.

Identification of those signals and frequency channels/bands for mobile communication, which do not affect human cells, is needed as a high priority task for the development of safe mobile communication.

Acknowledgements

Financial supports from the Swedish Council for Working Life and Social Research, the Swedish Radiation Protection Authority, the National Scholarship Program of the Slovak Republic, and the Russian Foundation for Basic Research are gratefully acknowledged.

Annexe 2 : Expertise et résumées de revues de littérature par Dr Neil Cherry :

ICNIRP critique 2000CRITICISM OF THE HEALTH ASSESSMENT IN THE ICNIRP GUIDELINES FOR RADIOFREQUENCY AND MICROWAVE RADIATION (100 kHz - 300 GHz)

http://www.neilcherry.com/documents/90_m4_EMR_ICNIRP_critique_09-02.pdf

Abstract:

Dr Cherry was invited by the Ministry of Health/ Ministry for the Environment of New Zealand to carry out a peer-review of the proposal to adopt the ICNIRP guidelines for cell sites in New Zealand, in November 1999. The ICNIRP guidelines were covered by a published assessment in 1998. This review shows that the assessment had ignored all published studies showing chromosome damage. It was highly selective, biased and very dismissive of the genotoxic evidence and the epidemiological evidence of cancer effects and reproductive effects. The assessment gives the strong impression of

being predetermined in the belief that the only effects were from high exposures that cause electric shocks and acute exposures that cause tissue heating. For, example, they cite two studies saying that they do not show any significant increased effects of Brain/CNS cancer from microwave exposures when the actual published papers, Grayson (1996) and Beall et al. (1996), both do show significant increases of Brain/CNS cancer.

Size: 158 pages, 1162 KB.

Extraits :

Dr Adey was basing his insights on a fascination with discovering how neurological tissue operated and how it was altered in extremely low level RF/MW and ELF fields. The current world leader in Ca^{2+} efflux research is Dr Carl Blackman of the U.S.E.P.A. Blackman has replicated and significantly extended the studies carried out by Dr Adey's group and other groups. Dr Blackman has produced over 2 dozen peer-reviewed publications in this area, including several major reviews.

Blackman et al. (1989) identified multiple power density windows for Ca^{2+} efflux, using a 50 MHz carrier modulated at 16 Hz. Their results, using units of mW/cm^2, are summarized as follows:
No change 0.75 2.30 4.50 5.85 7.08 8.19 8.66 10.6 14.7
Enhanced efflux 1.75 3.85 5.57 6.82 7.65 7.77 8.82
The intensity window data was considered as an example of non-linear dynamics because there appears to be no progressive decline in the magnitude of the effects at low exposure intensities. This data is consistent with a fractal process with a non-integer dimension which is approximately 1.4, Blackman et al. (1989).
The lowest published RF intensity that has been documented to produce significant Ca^{2+} efflux is 0.00015 W/kg from Schwartz et al. (1990). They used frog hearts, exposed for 30 mins, to a 16Hz modulated 240 MHz RF signal. This has an exposure intensity of about $0.4\mu W/cm^2$.
Blackman's group confirmed and significantly extended the "windows" concept of Ca^{2+} efflux, as well as aspects of homeostasis, involving tissue temperature for example. Figure 11 shows how modulation frequencies out to 510 Hz produce significant Ca^{2+} efflux at some frequencies, but not at other frequencies on either side (…)

Blackman et al. (1990) showed the importance of the local static magnetic field and Blackman et al. (1991) showed that Ca^{2+} efflux occurred for tissue temperatures of 36 and 27 □C and not at 35 and 38□C. They comment that these could be very good reasons why experimental outcomes have been difficult to confirm in some laboratories.
After reviewing the many studies in the published literature on EMR induced Ca^{2+} efflux. Blackman (1990) concludes:
"Taken together, the evidence overwhelmingly indicates that electric and magnetic fields can alter normal calcium ion homeostasis and lead to changes in the response of biological systems to their environment".
Blackman (1990) concludes that calcium ion efflux/influx is an established biological effect of EMR exposure (…)

6.3 Health implications of induced alterations in calcium ion homeostasis:

Induced alteration of cellular calcium ions:
 of brain cells is associated with behavioural and reaction time changes and associated EEG alterations, Bawin et al. (1978);
 of the pineal gland reduces the nocturnal production of melatonin (which increases the cell damage throughout the body, reduces the integrity and competence of the immune system, and hence increases the incidence of cancer and immune system related disease and degenerative diseases of the brain, Reiter (1994) and Walleczek (1992);
 of lymphocytes reduced the competence of the immune system making the subject more vulnerable to allergens, toxins and viruses, and to leukaemia; and
 of damaged cells alters the ratio of surviving neoplastically transformed cells and those programmed to self destruct (apoptosis), Balcer-Kubiczek (1995).
The neurological role of Ca^{2+} is well described and documented by Dr Adey. A university text on the molecular biology of the cell, Alberts et al. (1994), documents many cellular processes which depend on Ca^{2+}, including cell-cell adhesion, gap junction gating, intracellular mediation, cyclic AMP and ATPase processes, and signal transduction as a second messenger. Ca^{2+} mediate process in the hyppocampus involved with learning. They also mediate apoptosis. Chemical carcinogens, such as the tumor promoting phorbol esters, for example TPA, act by elevating intracellular calcium, Balcer-Kubiczek (1995).

6.4 Dr Alan Frey directly challenges the RF Thermal view.
Dr Frey, an eminent U.S. biologist, has several decades of EMR research including being the discoverer of "Microwave Hearing". In the introductory chapter of a book that he edited, Dr Frey describes the historical tendency to use the toxicological model that treats EMR as an external agent, Frey (1995). He then refers to Burke and others who have made it clear that "our frame of reference determines what we look at and how we look. And as a consequence, this determines what we find." This is demonstrably true for the ICNIRP assessors. Dr Frey than states "Theory and data show that this is the wrong model. Electromagnetic fields are not a foreign substance to living beings, like lead or cyanide."

"To model how em fields affect living beings, one might compare them to the radio we use to listen to music. The em signal the radio picks up and transduces into the sound of music is almost unmeasurably weak. At the same time there are, in total, strong em fields impinging on the radio. We don't notice the stronger em signals because they are not the appropriate frequency or modulation. Thus they don't disturb the music we hear. However, if you impose on the radio an appropriately tuned em field or harmonic, even if it is very weak, it will interfere with the music. Similarly, if we impose a very weak em signal on a living being, it has the possibility of interfering with normal function if it is properly tuned. This is the model that much biological data and theory tell us to use, not a toxicology model."
Wever (1974) and Konig (1974) proved that human brains are tuned to detect and use the Schumann Resonances that have an intensity of the vertical electric field component of about $0.1pW/cm^2$. This is 10 billion (10^{10}) times lower than the ICNIRP guideline for low frequency signals. Ahissar et al. (1997) demonstrated that mammals brains contain

biochemical phase-locked loop circuits to detect the phase difference between incoming ELF signals in the same manner as FM radio receivers.

(…)
Ten studies show that RF/MW exposure and ELF exposure can *reduce pineal melatonin production in people*. Evidence that EMR reduced melatonin in human beings commenced with Wang (1989) who found that workers who were more highly exposed to RF/MW had a dose-response increase in serotonin, and hence indicates a reduction in melatonin. Nine studies have observed significant EMR associated melatonin reduction in humans. They involve a wide range of exposure situations, including 50/60 Hz fields, Wilson et al. (1990), Graham et al. (1994), Wood et al. (1998), Karasek et al. (1998), and Burch et al. (1997, 1998), 16.7 Hz fields , Pfluger et al. (1996), VDTs Arnetz et al. (1996), a combination of 60 Hz fields and cell phone use, Burch et al. (1997), and a combination of occupational 60Hz exposure and increased geomagnetic activity around 30nT, Burch et al. (1999). The tenth human melatonin reduction study is from RF exposure as reported during the shutting down process of the Schwarzenburg shortwave radio tower, Professor Theo Abelin (seminar and pers.comm.).

Epidemiological principles for ELF/EMR Studies.

http://www.neilcherry.com/documents/90_p1_EMR_Epidemiological_Principles_for_EMF_and_EMR_Studies.pdf

Abstract:

Epidemiology is fundamental science and the strongest evidence for the assessment of human health effects of disease agents. Moving from a possible association to a causal effect the assessment principles are followed by the Sir Austin Bradford-Hill approach. When dealing with the health effects of electromagnetic fields and radiation some specific and important epidemiological principles must be used. Exposure assessments are vital. Electromagnetic fields and radiation are invisible, odourless, silent and tasteless, and are ubiquitous. Therefore the basic physics and engineering principles that explain the nature and strength of these fields are fundamental. The basic methods of environmental epidemiology involve identifying the disease rates in an exposed group to compare the disease rates in a non-exposed group, with no confounders to confuse the results. A major problem with EMF and EMR is that in most communities there is no non-exposed reference group because we live in homes with electromagnetic fields from electric power wires and appliances and we can receive radio, TV and cellphone signals all the time in our homes. Everyone in the world is exposed to radio short-waves and satellite microwaves. This has led to the Ubiquitous Exposure (No Non-exposed Group) Principle, an extension of the Healthy Worker Effect. For studies around Radio, TV and cell site transmission towers, the horizontal antenna patterns are used to focus most of the RF energy to where most of the receiving population lives. The vertical antenna patterns are a function of the frequency of the carrier signal. They have main beams and many side-lobes which produce complex radial undulating signal intensity, varying with distance from the tower. For studies of people living in the vicinity of radio, TV and cellphone towers it is vital that the radiation patterns and population patterns are understood. Studies that appropriately match exposure with cancer and other health effects, show strong, consistent and significant dose-response relationships indicating causal linkage between electromagnetic fields and radiation and human health effects

Le reste de l'annexe 2, sert à montrer la complexité des effets des radiofréquences, et l'incapacité de les réduire à l'échauffement des tissus ou leurs conséquences, comme le soutien Industrie-Canada et Santé-Canada.

Epidemiological studies of enhanced Brain CNS Cancer incidence and mortality from EMR/EMF exposures. http://www.neilcherry.com/documents/90_s2_EMR_Brain_cancer_paper09-02.pdf

Abstract:

A very large number of epidemiological studies relate EMF and EMR exposures to Brain/CNS Cancers and a large laboratory set of studies show that the EMF fields and EMR damage DNA. Taken together, they give robust support for the hypothesis that oscillating Electromagnetic Fields and Radiation are a Ubiquitous Universal Genotoxic Carcinogen. Brain Cancer is shown to be elevated in over 400 exposed groups with over 50 dose-response relationships. Both residential studies and occupational studies show elevated, significantly raised and dose-response increased Brain/CNS Cancer rates from EMF/EMR chronic exposures. The evidence is substantially higher than the classical causal linkage. The EMF/EMR fields have been introduced into homes, schools, buildings, factories and along streets, covering more and more of the areas in the developed world over the past century. Over the 20th century these fields have contributed a major proportion of the increase in cancer, by a factor of 50 to 80% of the 6- to 7-fold total increase, because of the unique ubiquitous nature of exposures to the EM fields and the RF/MW radiation. There is robust evidence of the oscillating electromagnetic spectrum from ELF to RF/MW being Genotoxic and Carcinogenic. Therefore this generates the Ubiquitous Genotoxic Carcinogen Effect (UGCE) which results from the absence of a non-exposed control group. The UGCE has been almost universally ignored in published epidemiological studies even though together they support and confirm the hypothesis. The UGCE, along with the Healthy Worker Effect, mean that the epidemiological cancer Odd Ratios (OR) and Relative Risks (RR) are grossly under-estimated because of the lack of a non-exposed control group. The genotoxic nature of these fields is so strong that exposed parents pass cancer, including Brain Cancer, on to their children. This review shows that there is strong and robust evidence that chronic exposures to ELF/RF/MW fields across the spectrum, through strength, consistency, biological plausibility and many dose-response relationships, cause increased rates of Brain/CNS Cancer from residential and occupational exposures. There is no safe threshold because of the genotoxic nature of the biological mechanism.

Size: 34 pages, 193 KB.

Independent academic review of biological and epidemiological effects of cellphone radiation. http://www.neilcherry.com/documents/90_r1_EMR_Cell_phone_review_paper.pdf

Abstract:

The widespread and massively growing rate of usage of mobile phones around the world is leading to having over a billion people using their phones most days. Initially we had bag phones and car phones, over 10 years ago we moved to portable handsets which originally were analogue phones and now most of the phones are digital. With the phone held against the ear the exposure of the head to modulated or digitally pulsed microwaves from the antenna, is very high. The head is a very sensitive

bioelectromagnetic organ. Therefore resonance absorption and electrical interference are classical biophysics mechanisms. Cherry (2002) shows that natural electromagnetic radiation, the Schumann Resonance signal, when it is modulated by Solar Activity, is associated with modulation of human health effects, including cancer, cardiac, reproductive and neurological diseases and mortality. The study also shows that similar elevated health effects are found in electrical workers and physiotherapists exposed to short wave and microwaves. Since the cellphone radiation exposes the user?s body to about a million times higher and the head to about a billion times higher exposure than the mean Schumann resonance signal, it is scientifically plausible that the same effects will be found from exposure to cellphone radiation. This review confirms that scientific studies show all these effects from exposure to cellphone radiation. It is therefore scientifically plausible that these health effects will be found in populations living within the vicinity of cellphone sites and from using cellphones.

Childhood Cancer in the vicinity of the Sutro Tower, San Francisco.

http://www.neilcherry.com/documents/90_r3_EMR_Sutro_Paper_09-02.pdf

Abstract:

The Sutro Tower is a prominent structure on an elevated site in San Francisco. Since 1973 it has provided radio and TV signals for the San Francisco Bay region. There have been long-standing concerns about the health effects of this high-powered transmitter located in the centre of a large urban population. The a priori hypothesis is that RF/MW radiation is a Ubiquitous Universal Genotoxic Carcinogen. This is based on a number of occupational studies and previous studies that have shown elevated cancer rates in residential populations living in the vicinity of radar and RF/MW broadcast towers. It is supported by many laboratory studies showing that ELF and RF/MW signals damage DNA. Thus it is predicted that at residential levels of RF/MW exposure cancer rates will increase in the vicinity of the Sutro Tower. This is tested by using the childhood cancer data-set from 1973-1988 with residential locations analysed to see if there is elevation of cancer and possible dose-response relationships. All of the analyses support and together confirm the hypothesis, and the radial patterns eliminate potential confounding factors.

Size: 23 pages, 265 KB.

Living near a broadcast tower can be hazardous to your healthHealth Effects in the vicinity of Radio/TV towers and mobile phone base stations.

http://www.neilcherry.com/documents/90_r2_EMR_Living_Near_Broadcast_Towers_Health.pdf

Abstract:

There is robust scientific evidence that electromagnetic radiation is a Ubiquitous Universal Genotoxic Carcinogen. If this understanding was applied to the data available in 1982, when IARC declared benzene a Human Carcinogen, then the level of data for RF/MW radiation being a human carcinogen was considerably stronger than that for benzene. A large body of laboratory experiments and epidemiological studies now confirm the hypothesis. The evidence is further strengthened through the biophysics understanding of the EMR Spectrum Principle. This shows that as the carrier frequency

increases the dielectric constant declines and the induced tissue electric field and induced current increases significantly. This implies and confirms that all of the health effects found in "electrical workers" will be found at much lower mean exposure levels in the vicinity of broadcast towers. Where studies have been carried out, the adverse health effects have been found. When compared with actual radiation patterns they show a causal effect. This confirms that hypothesis and the toxicology of the signals with a safe level of zero exposure. Hence living in the vicinity of broadcast and mobile phone towers produces Cancer, Cardiac, Reproductive and Neurological (CCRN) health effects. It is highly probable that these adverse health effects will be found in the vicinity of cell sites. Because of the small population numbers around single sites, these effects will only be detectable by studying populations around hundreds of cell sites.

Sleep disturbance in the vicinity of the Schwarzenburg Short-wave radio tower in Switzerland was causally related to the RF exposure through dose-response relationships, experimental confirmation and a measured reduction in melatonin in cows and people. A study in France has already shown an exposure-related dose-response in sleep disturbance (and other neurological symptoms) around cell towers, confirming that the effects are the same from cellphone radiation at residential exposure levels. Cellphone radiation also damages DNA. Therefore it is a serious health hazard, even at residential exposure levels, for all CCRN effects.

Introduction (90_r2_EMR_Living_Near_Broadcast_Towers)

The World Health Organization (WHO) and the international Commission on Non-Ionizing Radiation Protection (ICNIRP) correctly state that exposure assessment is critical to adequately assess health effects from electromagnetic radiation (EMR). This is vital for carrying out and interpreting epidemiological studies of cancer around radar, radio and TV broadcast transmitter sites. Two vital exposure principles are that the study needs to take into account the radial exposure patterns produced by horizontal and vertical antenna patterns and recognize that the far-field exposure experienced by residents, exposed the whole body and not just one particular organ. A second vital study principle involves the population distribution, especially considering what the population density is near the towers. For example, if few people live within 1 km of the tower than very few, if any, cancer cases are expected in the near vicinity of the tower. The third assessment principle is appreciation of the evidence that EMR is genotoxic. Evidence of genotoxicity is given by chromosome aberrations (CA), micronuclei formation (MF), DNA strand breakage (DNA), enhanced oncogene activity (OA), enhanced cell neoplastic transformation (NP) and induced toxic (heat) shock protein activity (TSP). The ICNIRP (1998) assessment fails to consider over 20 studies of EMR induced CA or MF, as well as misinterpreting the epidemiological evidence.

These principles are basic common sense. However when the WHO agency IARC (international Cancer Research Agency) fails assesses the evidence of RF/MW being a human universal carcinogen (causing cancer across many body organs) because the whole body is exposed. Failure to recognize this leads to incorrect assessments by ICNIRP (1998) and Elwood (1999).

This study will assess the evidence based on these basic principles. This shows that the adverse health effects of radiofrequency/microwave (RF/MW) radiation are clear and robustly demonstrated, supporting the hypothesis that EMR is a Ubiquitous Universal Genotoxic Carcinogen. This implies that EMR also damages the brain, the heart, the

central nervous system and the reproductive system, causing elevated rates of many diseases. Epidemiological evidence confirms that EMR exposure causes elevated incidence of all these types of disease and death rates.
When assessing cancer from exposure to a chemical there is an open question because it is already known that some chemicals do cause cancer. Hence the question is, ‘‘does this chemical produce cancer?’’. When occupational studies find elevated cancer rates in chemically exposed workers then the chemical is declared a human carcinogen with as little as 5 studies, only two of which show significant elevation of the cancer rate. This was in the case for the IARC assessment of Benzene in 1982. This approach is supported because chemicals are often associated with a specific cancer type. For benzene it was originally leukaemia, predominantly myelogenous leukaemia, IARC (1982). Now we know that Benzene is genotoxic and produces a wide range of cancers, Hayes et al. (1996).

Salzburg, Austria, in 2000 and was updated for Tokyo in 2002.

Size: 41 pages, 420 KB.

World Conference on Breast Cancer - Ottawa, Canada, 26-31 July 1999.

http://www.neilcherry.com/documents/90_s3_EMR-EMF_and_BREAST_Cancer.pdf

Abstract:

Breast cancer is a serious problem for women and also a risk for men. In assessing the risk of breast cancer associated with exposure to electromagnetic fields and radiation (EMF & EMR) this review approaches the problem primarily from both the whole-body point of view. Our minds control many body functions through the central nervous system and through mediating a wide range of hormones. This includes melatonin, which is a highly potent free radical scavenger. Hence melatonin protects cells from cancer and it strengthens the immune system. EMR is shown to influence the brain, reduce the output of key hormones (e.g. Melatonin and Thyrotropin), and to impair the immune system. Thus EMR is carcinogenic. Alteration of cellular calcium ions is a well-established biological effect of EMR exposure. Calcium ion influx is associated with the survival of damaged cells, and thus increases cancer risk. Calcium ion efflux is associated with enhanced cell death (apoptosis) of damaged cells, and hence enhances neurodegenerative diseases. Calcium ion efflux is also related to impairment of the immune system, and to alteration of reaction times and brain EEG rhythms.

German research has proven that human brains detect and use the Schumann Resonances (SR) for timing synchronization. Altering the intensity and frequency of the SR changes human reaction times and circadian rhythms. A large body of research shows that there is an optimal intensity of SR, with increases and decreases in natural EMR being associated with a wide range of adverse neurological and cardiac health effects, and breast cancer. This research proves that sensitive and vulnerable human beings are made ill and can die when the natural EMR changes. The mean ELF intensity level of the SR is about 0.1 pW/cm2. This is 2 billion times lower than internationally recommended public health guidelines for ELF exposure.

Cell line and animal exposure experiments, and epidemiological studies of populations who are occupationally and residentially exposed to EMR reveal significant hormonal, neurological, cardiac and cancer effects. A series of laboratory experiments involving breast cancer prone rats exposed to 50/60Hz exposure down to 0.1mT EMF, produced dose response relationships with the size and

number of mammary tumors, with melatonin reduction and with reduced T lymphocytes. They also show a significant increase in proto oncogene activity. Occupational and residential studies of human populations show significant increases in breast cancer across the EMR spectrum, especially for pre-menopausal women and for positive estrogen receptor breast cancer. Since cell phones pose a very high risk it is recommended that all EMR exposures, especially cell phone exposure, be minimized.

Size: 40 pages, 331 KB.

Annexe 3 : extraits et conclusions de Johansson, portant sur les effets immunitaires de l'exposition aux radiofréquence, et contenu dans le chapitre 8 du rapport Bioinitiative, traitant des effets sub-thermiques de l'exposition aux champs électromagnétiques et radiofréquences. (pp.18-28). Cette annexe porte uniquement sur les effets immunitaire. Avec l'annexe 3 (Havas), elle sert à monter l'insuffisance des critères thermiques seuls, autant que la diversité des effets et des conditions qui les engendrent, à des niveaux sub-thermiques. Les annexe 2, 3 et 4 offrent un coup d'oeuil étroit sur l'étendue de la recherche scientifique conduite dans le domaine des effets de santé des radio-fréquences à des niveaux sub-thermiques. L'étendue et la qualité de la recherche justifie un changement de cadre d'évaluation des effets des radiofréquences sur la santé.

VI. Direct effects of EMFs on the immune system

Childhood leukemia was early connected to power-frequent magnetic fields already in the pioneering work by Wertheimer and Leeper (1979), and more recently Scandinavian scientists have identified an increased risk for acoustic neuroma (i.e., a benign tumor of the eighth cranial nerve) in cell phone users, as well as a slightly increased risk of malignant brain tumors such as astrocytoma and meningioma on the same side of the brain as the cell phone was habitually held (Hardell et al, 1999, 2004, 2005; Lonn et al, 2004). In addition, a clear association between adult cancers and FM radio broadcasting radiation has been noticed, both in time and location (Hallberg and Johansson, 2002b, 2004a, 2005a). Initial studies on facial nevi indicates that nowadays also young children can have a substantial amount of these. If it can be shown that radiofrequency radiation is not correlated with childhood cancers the current focus on low-frequency electromagnetic fields can continue. If there is also a radiofrequency and/or microwave correlation then this must be considered in future research as well as in today's preventive work.

Anane and coworkers (2003) studied the effects of acute exposure to GSM-900 microwaves (900 MHz, 217 Hz pulse modulation) on the clinical parameters of the acute experimental allergic encephalomyelitis (EAE) model in rats in two independent experiments: rats were either habituated or nonhabituated to the exposure restrainers. EAE was induced with a mixture of myelin basic protein and Mycobacterium tuberculosis. Female Lewis rats were divided into cage control, sham exposed, and two groups exposed either at 1.5 or 6.0 W/kg local specific absorption rate (SAR averaged over the brain) using a loop antenna placed over their heads. No

effect of a 21-day exposure (2 h/day) on the onset, duration, and termination of the EAE crisis was seen.
The object of the study by Boscol et al. (2001) was to investigate the immune system of 19 women with a mean age of 35 years, for at least 2 years (mean = 13 years) exposed to electromagnetic fields induced by radiotelevision broadcasting stations in their residential area. In September 1999, the EMFs (with range 500 KHz-3 GHz) in the balconies of the homes of the women were (mean +/- S.D.) 4.3 +/- 1.4 V/m. Forty-seven women of similar age, smoking habits and atopy composed the control group, with a nearby resident EMF exposure of < 1.8 V/m. Blood lead and urinary trans-trans muconic acid (a metabolite of benzene), markers of exposure to urban traffic, were higher in the control women. The EMF exposed group showed a statistically significant reduction of blood NK CD16+-CD56+, cytotoxic CD3(-)-CD8+, B and NK activated CD3(-)-HLA-DR+ and CD3(-)-CD25+ lymphocytes. 'In vitro' production of IL-2 and interferon-gamma (INF-gamma) by peripheral blood mononuclear cells (PBMC) of the EMF exposed group, incubated either with or without phytohaemoagglutinin (PHA), was significantly lower; the 'in vitro' production of IL-2 was significantly correlated with blood CD16+-CD56+ lymphocytes. The stimulation index (S.I.) of blastogenesis (ratio between cell proliferation with and without PHA) of PBMC of EMF exposed women was lower than that of the control subjects. The S.I. of blastogenesis of the EMF exposed group

(but not blood NK lymphocytes and the 'in vitro' production of IL-2 and INF-gamma by PBMC) was significantly correlated with the EMF levels. Blood lead and urinary trans-trans muconic acid were barely correlated with immune parameters: the urinary metabolite of benzene of the control group was only correlated with CD16+-CD56+ cells indicating a slight effect of traffic on the immune system. In conclusion, this study demonstrates that high-frequency EMFs reduce cytotoxic activity in the peripheral blood of women without a dose-response effect. Such an effect could, of course, only be considered as very serious, since this could hamper the immune system in it’s daily struggle against various organisms/agents.
On the other hand, Chagnaud and Veyret in 1999 could not demonstrate an effect of low-level pulsed microwaves on the integrity of the immune system. They investigated the effects of GSM-modulated microwaves on lymphocyte subpopulations of Sprague-Dawley rats and their normal mitogenic responses using flow cytometry analysis and a colorimetric method. No alterations were found in the surface phenotype of splenic lymphocytes or in their mitogenic activity.
Cleary et al. (1990) reported a biphasic, dose-dependent effect of microwave radiation on lymphycyte proliferation with non-thermal exposures. Whole human blood was exposed or sham-exposed in vitro for 2 h to 27 or 2,450 MHz radiofrequency electromagnetic (RF) radiation under isothermal conditions (i.e., 37 +/- 0.2 degrees C). Immediately after exposure, mononuclear cells were separated from blood by Ficoll density-gradient centrifugation and cultured for 3 days at 37 degrees C with or without mitogenic stimulation by phytohemagglutinin (PHA). Lymphocyte proliferation was assayed at the end of the culture period by 6 h of pulse-labeling with 3H-thymidine (3H-TdR). Exposure to radiation at either frequency at specific absorption rates (SARs) below 50 W/kg resulted in a dose-dependent, statistically significant increase of 3H-TdR uptake in PHA-activated or unstimulated lymphocytes. Exposure at 50 W/kg or higher suppressed 3H-TdR uptake relative to that of sham-exposed cells. There were no detectable effects of RF radiation on lymphocyte morphology or viability. Notwithstanding the characteristic temperature dependence of lymphocyte activation in vitro, the isothermal exposure conditions of

this study warrant the conclusion that the biphasic, dose-dependent effects of the radiation on lymphocyte proliferation were not dependent on heating.
Cleary et al. (1996) subsequently published yet another paper reporting a biphasic response of lymphycytes to radiofrequency/microwave radiation where higher SARs resulted in decreased cell proliferation and lower SARs result in increased cell proliferation, dependent on the mitotic state of the cells. Previous in vitro studies had provided evidence that RF electromagnetic radiation modulates proliferation of human glioma, lymphocytes, and other cell types. The mechanism of such RF radiation cell proliferation modulation, as well as mechanisms for effects on other cell physiologic endpoints, however, were not well understood. To obtain insight regarding interaction mechanisms, they investigated effects of RF radiation exposure on interleukin 2 (IL-2) -dependent proliferation of cytolytic T lymphocytes (CTLL-2). After exposure to RF radiation in the presence or absence of IL-2 cells were cultured at various physiological concentrations of IL-2. Treatment effects on CTLL-2 proliferation were determined by tritiated thymidine incorporation immediately or 24 h after exposure. Exposure to 2,450 MHz RF radiation at specific absorption rates (SARs) of greater than 25 W/kg (induced E-field strength 98.4 V/m) induced a

consistent, statistically significant reduction in CTLL-2 proliferation, especially at low IL-2 concentrations. At lower SARs, 2,450 MHz exposure increased CTLL-2 proliferation immediately after exposure but reduced 24 h post-exposure proliferation. RF radiation effects depended on the mitotic state of the cells at the time of exposure.
In 1992, Czerska et al. studied the effects of continuous and pulsed 2,450-MHz radiation on spontaneous lymphoblastoid transformation of human lymphocytes in vitro. Normal human lymphocytes were isolated from the peripheral blood of healthy donors. One-ml samples containing one million cells in chromosome medium 1A were exposed for 5 days to conventional heating or to continuous wave (CW) or pulsed wave (PW) 2,450-MHz radiation at non-heating (37 degrees C) and various heating levels (temperature increases of 0.5, 1.0, 1.5, and 2 degrees C). The pulsed exposures involved 1-microsecond pulses at pulse repetition frequencies from 100 to 1,000 pulses per second at the same average SAR levels as the CW exposures. Actual average SARs ranged to 12.3 W/kg. Following termination of the incubation period, spontaneous lymphoblastoid transformation was determined with an image analysis system. The results were compared among each of the experimental conditions and with sham-exposed cultures. At non-heating levels, CW exposure did not affect transformation. At heating levels both conventional and CW heating enhanced transformation to the same extent and correlate with the increases in incubation temperature. PW exposure enhanced transformation at non-heating levels. This finding is significant ($p<0.002$). At heating levels PW exposure enhanced transformation to a greater extent than did conventional or CW heating. This finding is significant at the 0.02 level. It was concluded that PW 2,450-MHz radiation acts differently on the process of lymphoblastoid transformation in vitro compared with CW 2,450-MHz radiation at the same average SARs.
In 2003, Dabrowski et al. exposed samples of mononuclear cells isolated from peripheral blood of healthy donors (n = 16) to 1,300 MHz pulse-modulated microwaves at 330 pps with 5 μs pulse width. The samples were exposed in an anechoic chamber at the average value of power density of S = 10 W/m_2 (1 mW/cm_2). The average specific absorption rate (SAR) was measured in rectangular waveguide and the value of SAR = 0.18 W/kg was recorded. Subsequently, the exposed and control cells were assessed in the microculture system for several parameters characterizing their proliferative and immunoregulatory properties. Although the

irradiation decreased the spontaneous incorporation of 3H-thymidine, the proliferative response of lymphocytes to phytohemagglutinin (PHA) and to Con A as well as the T-cell suppressive activity (SAT index) and the saturation of IL-2 receptors did not change. Nevertheless, the lymphocyte production of interleukin (IL)-10 increased ($p< 0.001$) and the concentration of IFNγ remained unchanged or slightly decreased in the culture supernatants. Concomitantly, the microwave irradiation modulated the monokine production by monocytes. The production of IL-1β increased significantly ($p< 0.01$), the concentration of its antagonist (IL-1ra) dropped by half ($p< 0.01$) and the tumor necrosis factor (TNF-α) concentration remained unchanged. These changes of monokine proportion (IL-1 β vs. IL-1ra) resulted in significant increase of the value of LM index ($p<0.01$), which reflects the activation of monocyte immunogenic function. The results indicate that pulse-modulated microwaves represent the potential of immunotropic influence, stimulating preferentially the immunogenic and proinflammatory activity of monocytes at relatively low levels of exposure,

Following these findings of G_o phase peripheral blood mononulclear cells (PBMC) exposed to low-level (SAR = 0.18 W/kg) pulse-modulated 1300 MHz microwave,s and subsequently cultured, demonstrating changed immune activity (as of above), in 2006 Stankiewicz and coworkers investigated whether cultured immune cells induced into the active phases of cell cycle (G_1, S) and then exposed to microwaves will also be sensitive to electromagnetic fields. An anechoic chamber containing a microplate with cultured cells and an antenna emitting microwaves (900 MHz simulated GSM signal, 27 V/m, SAR 0.024 W/kg) was placed inside an ASSAB incubator. The microcultures of PBMC exposed to microwaves demonstrated significantly higher response to mitogens and higher immunogenic activity of monocytes (LM index) than control cultures. The LM index, described in detail elsewhere (Dabrowski et al, 2001), represents the monokine influence on lymphocyte mitogenic response. The results suggest that immune activity of responding lymphocytes and monocytes can be additionally intensified by 900 MHz microwaves. The above described effects of an immune system activity-intensifying effect of 900 MHz microwaves are, of course, a very important warning signal as well as a very important piece of the explanatory jigsaw puzzle regarding, for instance, the functional impairment electrohypersensitivity. In the latter, affected persons very often describe “influenzalike” sensations in their body. Maybe the mobile phones, as well as other highfrequency devices, have aroused the immune system to a too high an activation level?
In an attempt to understand how non-atopic and atopic fertile women with uniform exposure to toxic compounds produced by traffic - immunologically react to high or low frequency electromagnetic fields (ELMF), Del Signore et al. (2000) performed a preliminary study. Women were divided in group A (non-atopic, non-exposed to ELMF); B (atopic, non-exposed to ELMF); C (non-atopic, exposed to ELMF); D (atopic, exposed to ELMF). In vitro cell proliferation of peripheral blood mononuclear cells (PBMC) of atopic women (groups B and D) stimulated by phytohaemoglutinin (PHA) was reduced. The ELMF exposed women (groups C and D) showed lower levels of blood NK CD16(+)-CD56+ lymphocyte subpopulations and of "in vitro" production of interferon-gamma (both spontaneously and in presence of PHA) by PBMC, suggesting that ELMF reduces blood cytotoxic activity. Serum IgE of the atopic women exposed to ELMF (group D) was higher than that of the other groups. Linear discriminant analysis including serum zinc and copper (essential enzymes for immune functions), blood lead and urinary transtrans muconic acid, a metabolite of benzene (markers of exposure to traffic) and key parameters of immune functions (CD16(+)-CD56+ lymphocyte subset, serum IgE, interferon-gamma

produced by PBMC in presence of PHA, stimulation index of blastogenesis) showed absence of significant difference between groups A and C and a marked separation of groups B and D. This datum suggests that ELMF have a greater influence on atopic women exposed to traffic than on non-atopic ones, again pointing out differing reaction capacities in the human population – maybe dependent on varying immune functions based on variations in genetic make-up.
A more general reaction pattern was found by Dmoch and Moszczynski (1998) who assessed immunoglobulin concentrations and T-lymphocyte subsets in workers of TV re-transmission and satellite communication centres. An increase in IgG and IgA

concentrations, an increased count of lymphocytes and T8 lymphocytes, an decreased count of NK cells and a lower value of T-helper/T-suppressor ratio were found.
Elekes et al. (1996) found a very interesting sex-difference. The effect of continuous (CW; 2.45 GHz carrier frequency) or amplitude-modulated (AM; 50 Hz square wave) microwave radiation on the immune response was tested. CW exposures (6 days, 3 h/day) induced elevations of the number of antibody-producing cells in the spleen of male Balb/c mice (+37%). AM microwave exposure induced elevation of the spleen index (+15%) and antibody-producing cell number (+55%) in the spleen of male mice. No changes were observed in female mice. It is concluded that both types of exposure conditions induced moderate elevation of antibody production only in male mice.
Irradiation with electromagnetic waves (8.15-18 GHz, 1 Hz within, 1 microW/cm2) in vivo increases the cytotoxic activity of natural killer cells of rat spleen (Fesenko et al, 1999a). In mice exposed for 24-72 h, the activity of natural killer cells increased by 130-150%, the increased level of activity persisting within 24 h after the cessation of treatment. Microwave irradiation of animals in vivo for 3.5 and 5 h, and a short exposure of splenic cells in vitro did not affect the activity of natural killer cells.
Whole body microwave sinusoidal irradiation of male NMRI mice with 8.15-18 GHz (1 Hz within) at a power density of 1 microW/cm2 caused a significant enhancement of TNF production in peritoneal macrophages and splenic T lymphocytes (Fesenko et al, 1999b). Microwave radiation affected T cells, facilitating their capacity to proliferate in response to mitogenic stimulation. The exposure duration necessary for the stimulation of cellular immunity ranged from 5 h to 3 days. Chronic irradiation of mice for 7 days produced the decreasing of TNF production in peritoneal macrophages. The exposure of mice for 24 h increased the TNF production and immune proliferative response, and these stimulatory effects persisted over 3 days after the termination of exposure. Microwave treatment increased the endogenously produced TNF more effectively than did lipopolysaccharide, one of the most potential stimuli of synthesis of this cytokine. Microwaves, thus, indeed can be a factor interfering with the process of cell immunity!
Gapeev et al. (1996) reported that low-intensity electromagnetic radiation of extremely high frequency in the near field of modified the acitivity of mouse peritoneal neutrophils in a quasi-reasonance fashion., He compared the effect of radiation from various types of antennae, including one which created a uniform spatial distribution of specific absorbed rating in the frequency range used and wideband matching with the object both in near field and far field zones of the radiator.
The authors extremely high frequency in near field zone but not the far field zone of the channel radiator modified the activity of mouse peritoneal neutrophils on a quasiresonance manner. The interaction of electromagnetic radiation with the biological object has been revealed in the narrow-band frequencies of 41.8-42.05 GHz and consists in inhibition of luminol-dependent chemiluminescence of neutrophils activated by opsonized zymosan. It is not found any frequency dependence of the

electromagnetic radiation effects in the far field zone of the radiator. The results obtained suggest, that the quasi-resonance dependence of the biological effect on the frequency of the electromagnetic radiation in the near field zone is conditioned by structure and nature of the electromagnetic radiation in this zone.

In 2003, Gatta et al. studied the effects of in vivo exposure to GSM-modulated 900 MHz radiation on mouse peripheral lymphocytes. The aim of this study was to evaluate whether daily whole-body exposure to 900 MHz GSM-modulated radiation could affect spleen lymphocytes. C57BL/6 mice were exposed 2 h/day for 1, 2 or 4 weeks in a TEM cell to an SAR of 1 or 2 W/kg. Untreated and sham-exposed groups were also examined. At the end of the exposure, mice were killed humanely and spleen cells were collected. The number of spleen cells, the percentages of B and T cells, and the distribution of T-cell subpopulations (CD4 and CD8) were not altered by the exposure. T and B cells were also stimulated ex vivo using specific monoclonal antibodies or LPS to induce cell proliferation, cytokine production and expression of activation markers. The results did not show relevant differences in either T or B lymphocytes from mice exposed to an SAR of 1 or 2 W/kg and sham-exposed mice with few exceptions. After 1 week of exposure to 1 or 2 W/kg, an increase in IFNgamma (Ifng) production was observed that was not evident when the exposure was prolonged to 2 or 4 weeks. This suggests that the immune system might have adapted (!) to RF radiation as it does with other stressing agents. All together, from their in vivo data, they made the conclusion that it indicated that the T- and B-cell compartments were not substantially affected by exposure to RF radiation and that a clinically relevant effect of RF radiation on the immune system is unlikely to occur. Another explanation could be that the cells were unable to deal with the exposure and the obvious follow-up question then will be: What happened with the immune cells after months and years of exposure?

On the other hand, Kolomytseva et al. (2002), in their whole-body exposure experiment designed to study the dynamics of leukocyte number and functional activity of peripheral blood neutrophils under whole-body exposure of healthy mice to low-intensity extremely-high-frequency electromagnetic radiation (EHF EMR, 42.0 GHz, 0.15 mW/cm2, 20 min daily), showed that such a whole-body exposure of healthy mice to low-intensity EHF EMR has a profound effect on the indices of nonspecific immunity. It was shown that the phagocytic activity of peripheral blood neutrophils was suppressed by about 50% ($p<0.01$ as compared with the shamexposed control) in 2-3 h after the single exposure to EHF EMR. The effect persisted for 1 day after the exposure, and then the phagocytic activity of neutrophils returned to the norm within 3 days. A significant modification of the leukocyte blood profile in mice exposed to EHF EMR for 5 days was observed after the cessation of exposures: the number of leukocytes increased by 44% ($p<0.05$ as compared with sham-exposed animals), mostly due to an increase in the lymphocyte content. The supposition was made that EHF EMR effects can be mediated via the metabolic systems of arachidonic acid and the stimulation of adenylate cyclase activity, with subsequent increase in the intracellular cAMP level.

The modification of indices of the humoral immune response to thymus-dependent antigen (sheep erythrocytes) after a whole-body exposure of healthy mice to lowintensity extremely-high-frequency electromagnetic radiation was reported by Lushnikov et al. in 2001. Male NMRI mice were exposed in the far-field zone of horn antenna at a frequency of 42.0 GHz and energy flux density of 0.15 mW/cm2 under different regimes: once for 20 min, for 20 min daily during 5 and 20 successive days before immunization, and for 20 min daily during 5 successive days after

immunization throughout the development of the humoral immune response. The intensity of the humoral immune response was estimated on day 5 after immunization

by the number of antibody-forming cells of the spleen and antibody titers. Changes in cellularity of the spleen, thymus and red bone marrow were also assessed. The indices of humoral immunity and cellularity of lymphoid organs changed insignificantly after acute exposure and series of 5 exposures before and after immunization of the animals. However, after repeated exposures for 20 days before immunization, a statistically significant reduction of thymic cellularity by 17.5% ($p<0.05$) and a decrease in cellularity of the spleen by 14.5% ($p<0.05$) were revealed. The results show that low-intensity extremely-high-frequency electromagnetic radiation with the frequency and energy flux density used does not influence the humoral immune response intensity in healthy mice but influences immunogenesis under multiple repeated exposures.

The immunoglobulins' concentrations and T lymphocyte subsets during occupational exposures to microwave radiation were assessed in 1999 by Moszczynski et al. In the workers of retransmission TV center and center of satellite communications on increased IgG and IgA concentration and decreased count of lymphocytes and T8 cells was found. However, in the radar operators IgM concentration was elevated and a decrease in the total T8 cell count was observed. The different behaviour of examined immunological parameters indicate that the effect of microwave radiation on immune system depends on character of an exposure. Disorders in the immunoglobulins' concentrations and in the T8 cell count did not cause any reported clinical consequences.

Experiments have also been conducted to elucidate the effects of chronic low powerlevel microwave radiation on the immunological systems of rabbits (Nageswari et al, 1991). Fourteen male Belgian white rabbits were exposed to microwave radiation at 5 mW/cm2, 2.1 GHz, 3 h daily, 6 days/week for 3 months in two batches of 7 each in specially designed miniature anechoic chambers. Seven rabbits were subjected to sham exposure for identical duration. The microwave energy was provided through S band standard gain horns connected to a 4K3SJ2 Klystron power amplifier. The first batch of animals were assessed for T lymphocyte-mediated cellular immune response mechanisms and the second batch of animals for B lymphocyte-mediated humoral immune response mechanisms. The peripheral blood samples collected monthly during microwave/sham exposure and during follow-up (5/14 days after termination of exposures, in the second batch animals only) were analysed for T lymphocyte numbers and their mitogen responsiveness to ConA and PHA. Significant suppression of T lymphocyte numbers was noted in the microwave group at 2 months (p less than 0.01) and during follow-up (p less than 0.01). The first batch animals were initially sensitised with BCG and challenged with tuberculin (0.03 ml) at the termination of microwave irradiation/sham exposure and the increase in foot pad thickness (delta mm), which is a measure of T cell-mediated immunity (delayed type hypersensitivity response, DTH) was noted in both the groups. The microwave group revealed a more robust response than the control group (delta % +12.4 vs. +7.54).

Nakamura et al. (1997) reported on the effect of microwaves on pregnant rats. The authors reported that microwaves at the power of 10 mW/cm2 produced activation of the hypothalamic-pituitary-adrenal axis and increased oestradiol in both virgin and pregnant rats, suggesting that microwaves greatly stress pregnant organisms. Earlier data had indicated that these microwaves produce various detrimental changes based on actions of heat or non-specific stress, although the effects of microwaves on

pregnant organisms was not uniform. This study was therefore designed to clarify the effect of exposure to microwaves during pregnancy on endocrine and immune functions. Natural killer cell activity and natural killer cell subsets in the spleen were measured, as well as some endocrine indicators in blood--corticosterone and adrenocorticotrophic hormone (ACTH) as indices of the hypothalamic-pituitaryadrenal axis--beta-endorphin, oestradiol, and progesterone in six female virgin rats and six pregnant rats (nine to 11 days gestation) exposed to microwaves at 10 mW/cm2 incident power density at 2,450 MHz for 90 minutes. The same measurements were performed in control rats (six virgin and six pregnant rats). Skin temperature in virgin and pregnant rats increased immediately after exposure to microwaves. Although splenic activity of natural killer cells and any of the subset populations identified by the monoclonal antibodies CD16 and CD57 did not differ in virgin rats with or without exposure to microwaves, pregnant rats exposed to microwaves showed a significant reduction of splenic activity of natural killer cells and CD16+CD57-. Although corticosterone and ACTH increased, and oestradiol decreased in exposed virgin and pregnant rats, microwaves produced significant increases in beta-endorphin and progesterone only in pregnant rats.

Nakamura et al. (1998) evaluated the involvement of opioid systems in reduced natural killer cell activity (NKCA) in pregnant rats exposed to microwaves at a relatively low level (2 mW/cm2 incident power density at 2,450 MHz for 90 min). They assayed beta-endorphin (betaEP) in blood, pituitary lobes, and placenta as well as splenic NKCA in virgin and/or pregnant rats. Although microwaves elevated colonic temperatures by 0.8 degrees C for virgin and 0.9 degrees C for pregnant rats, and betaEP in blood and anterior pituitary lobes (AP) significantly, it did not change blood corticosterone as an index of hypothalamic-pituitary adrenal axis. There were significant interactions between pregnancy and microwave exposure on splenic NKCA, betaEP in both blood and AP, and blood progesterone. Intra-peritoneal administration of opioid receptor antagonist naloxone prior to microwave exposure increased NKCA, blood, and placental betaEP in pregnant rats. Alterations in splenic NKCA, betaEP and progesterone in pregnant rats exposed to microwaves may be due to both thermal and non-thermal actions. These results suggest that NKCA reduced by microwaves during pregnancy is mediated by the pituitary opioid system.

To further clarify the effects of microwaves on pregnancy, Nakamura et al. (2000) investigated rats exposed to continuous-wave (CW) microwave at 2 mW/cm(2) incident power density at 2,450 MHz for 90 min.. The effects on uterine or uteroplacental blood flow and endocrine and biochemical mediators, including corticosterone, estradiol, prostaglandin E(2) (PGE(2)), and prostaglandin F(2)alpha (PGF(2)alpha) were measured, Colonic temperature in virgin and pregnant rats was not significantly altered by microwave treatment. Microwaves decreased uteroplacental blood flow and increased progesterone and PGF(2)alpha in pregnant, but not in virgin rats. Intraperitoneal (i.p.) administration of angiotensin II, a uteroplacental vasodilator, before microwave exposure prevented the reduction in uteroplacental blood flow and the increased progesterone and PGF(2)alpha in pregnant rats. Increased corticosterone and decreased estradiol during microwave exposure were observed independent of pregnancy and pretreatment with angiotensin II. These results suggest that microwaves (CW, 2 mW/cm(2), 2,450 MHz) produce uteroplacental circulatory disturbances and ovarian and placental dysfunction during pregnancy, probably through non-thermal actions. The uteroplacental disturbances

appear to be due to actions of PGF(2)alpha and may pose some risk for pregnancy. Reported pregnancy losses in women (Lee, 2001; Li, 2001) and infertility (Magras

and Xenos, 1997) might be related to these laboratory findings.
Nasta et al. (2006), very recently examined the effects of in vivo exposure to a GSMmodulated 900 MHz RF field on B-cell peripheral differentiation and antibody production in mice. Their results show that exposure to a whole-body average specific absorption rate (SAR) of 2 W/kg, 2 h/day for 4 consecutive weeks does not affect the frequencies of differentiating transitional 1 (T1) and T2 B cells or those of mature follicular B and marginal zone B cells in the spleen. IgM and IgG serum levels are also not significantly different among exposed, sham-exposed and control mice. B cells from these mice, challenged in vitro with LPS, produce comparable amounts of IgM and IgG. Moreover, exposure of immunized mice to RF fields does not change the antigen-specific antibody serum level. Interestingly, not only the production of antigen-specific IgM but also that of IgG (which requires T-B-cell interaction) is not affected by RF-field exposure. This indicates that the exposure does not alter an ongoing in vivo antigen-specific immune response. In conclusion, the results of Nasta et al. (2006) do not indicate any effects of GSM-modulated RF radiation on the B-cell peripheral compartment and antibody production.
Whole-body microwave sinusoidal irradiation of male NMRI mice, exposure of macrophages in vitro, and preliminary irradiation of culture medium with 8.15-18 GHz (1 Hz within) at a power density of 1 microW/cm2 caused a significant enhancement of tumor necrosis factor production in peritoneal macrophages (Novoselova et al, 1998). The role of microwaves as a factor interfering with the process of cell immunity must, thus, be seriously considered. Furthermore the effect of 8.15-18 GHz (1 Hz within) microwave radiation at a power density of 1 microW/cm2 on the tumor necrosis factor (TNF) production and immune response was tested by Novoselova et al. (1999). A single 5 h whole-body exposure induced a significant increase in TNF production in peritoneal macrophages and splenic T cells. The mitogenic response in T lymphocytes increased after microwave exposure. The activation of cellular immunity was observed within 3 days after exposure. The diet containing lipid-soluble nutrients (beta-carotene, alpha-tocopherol and ubiquinone Q9) increased the activity of macrophages and T cells from irradiated mice.
Obukhan (1998) has performed cytologic investigations designed to study bone marrow, peripheral blood, spleen, and thymus of albino rats irradiated by an electromagnetic field, 2,375, 2,450, and 3,000 MHz. Structural and functional changes in populations of megakaryocytes, immunocompetent cells as well as of undifferentiated cells, and of other types of cells that are dependent on the intensity of irradiation.
The possibility of genotoxicity of radiofrequency radiation (RFR) applied alone or in combination with x-rays was recently investigated in vitro using several assays on human lymphocytes by Stronati and colleagues (2006). The chosen specific absorption rate (SAR) values are near the upper limit of actual energy absorption in localized tissue when persons use some cellular telephones. The purpose of the combined exposures was to examine whether RFR might act epigenetically by reducing the fidelity of repair of DNA damage caused by a well-characterized and

established mutagen. Blood specimens from 14 donors were exposed continuously for 24 h to a Global System for Mobile Communications (GSM) basic 935 MHz signal. The signal was applied at two SAR; 1 and 2 W/Kg, alone or combined with a 1-min exposure to 1.0 Gy of 250 kVp x-rays given immediately before or after the RFR. The assays employed were the alkaline comet technique to detect DNA strand breakage, metaphase analyses to detect unstable chromosomal aberrations and sister chromatid

exchanges, micronuclei in cytokinesis-blocked binucleate lymphocytes and the nuclear division index to detect alterations in the speed of in vitro cell cycling. By comparison with appropriate sham-exposed and control samples, no effect of RFR alone could be found for any of the assay endpoints. In addition RFR did not modify any measured effects of the x-radiation. In conclusion, this study has used several standard in vitro tests for chromosomal and DNA damage in Go human lymphocytes exposed in vitro to a combination of x-rays and RFR. It has comprehensively examined whether a 24-h continuous exposure to a 935 MHz GSM basic signal delivering SAR of 1 or 2 W/Kg is genotoxic per se or whether, it can influence the genotoxicity of the well-established clastogenic agent; x-radiation. Within the experimental parameters of the study in all instances no effect from the RFR signal was observed.

Tuschl et al. (1999) recorded a considerable excess of recommended exposure limits in the vicinity of shortwave diathermy devices used for medical treatment of patients. Different kinds of field probes were used to measure electric and magnetic field strength and the whole body exposure of medical personnel operating shortwave, decimeter wave and microwave units was calculated. To investigate the influence of chronic exposure on the immune system of operators, blood was sampled from physiotherapists working at the above mentioned devices. Eighteen exposed and thirteen control persons, matched by sex and age, were examined. Total leucocyte and lymphocyte counts were performed and leucocytic subpopulations determined by flow cytometry and monoclonal antibodies against surface antigens. In addition, to quantify subpopulations of immunocompetent cells, the activity of lymphocytes was measured. Lymphocytes were stimulated by mitogen phytohemagglutinin and their proliferation measured by a flow cytometric method. No statistically significant differences between the control and exposed persons were found. In both study groups all immune parameters were within normal ranges.

Despite the important role of the immune system in defending the body against infections and cancer, only few investigations on possible effects of radiofrequency (RF) radiation on function of human immune cells have been undertaken. One of these is the investigation by Tuschl et al. in 2005 where they assessed whether GSM modulated RF fields have adverse effects on the functional competence of human immune cells. Within the frame of the multidisciplinary project "Biological effects of high frequency electromagnetic fields (EMF)" sponsored by the National Occupation Hazard Insurance Association (AUVA) in vitro investigations were carried out on human blood cells. Exposure was performed at GSM Basic 1950 MHz, an SAR of 1 mW/g in an intermittent mode (5 min "ON", 10 min "OFF") and a maximum Delta T of 0.06 degrees C for the duration of 8 h. The following immune parameters were evaluated: (1) the intracellular production of interleukin-2 (IL-2) and interferon (INF) gamma in lymphocytes, and IL-1 and tumor necrosis factor (TNF)-alpha in monocytes were evaluated with monoclonal antibodies. (2) The activity of immunerelevant genes (IL 1-alpha and beta, IL-2, IL-2-receptor, IL-4, macrophage colony stimulating factor (MCSF)-receptor, TNF-alpha, TNF-alpha-receptor) and

housekeeping genes was analyzed with real time PCR. (3) The cytotoxicity of lymphokine activated killer cells (LAK cells) against a tumor cell line was determined in a flow cytometric test. For each parameter, blood samples of at least 15 donors were evaluated. No statistically significant effects of exposure were found and there is no indication that emissions from mobile phones are associated with adverse effects on the human immune system.

Irradiation by pulsed microwaves (9.4 GHz, 1 microsecond pulses at 1,000/s), both

with and without concurrent amplitude modulation (AM) by a sinusoid at discrete frequencies between 14 and 41 MHz, was assessed for effects on the immune system of Balb/C mice (Veyret et al, 1991). The mice were immunized either by sheep red blood cells (SRBC) or by glutaric-anhydride conjugated bovine serum albumin (GABSA), then exposed to the microwaves at a low rms power density (30 microW/cm2; whole-body-averaged SAR approximately 0.015 W/kg). Sham exposure or microwave irradiation took place during each of five contiguous days, 10 h/day. The antibody response was evaluated by the plaque-forming cell assay (SRBC experiment) or by the titration of IgM and IgG antibodies (GA-BSA experiment). In the absence of AM, the pulsed field did not greatly alter immune responsiveness. In contrast, exposure to the field under the combined-modulation condition resulted in significant, AM-frequency-dependent augmentation or weakening of immune responses.

Finally, in addition, classical allergy reactions, such as chromate allergy, has been studied by Seishima et al. (2003). The background for the study was an earlier case report about a patient with allergic contact dermatitis caused by hexavalent chromium plating on a cellular phone. The new study described the clinical characteristics and results of patch tests (closed patch tests and photopatch tests were performed using metal standard antigens) in 8 patients with contact dermatitis possibly caused by handling a cellular phone. The 8 patients were 4 males and 4 females aged from 14 to 54 years. They each noticed skin eruptions after 9-25 days of using a cellular phone. All patients had erythema, and 7 had papules on the hemilateral auricle or in the preauricular region. Three of 8 patients had a history of metal allergy. Chromate, aluminium and acrylnitrile-butadienestyrene copolymer were used as plating on the cellular phones used by these patients. The patch test was positive for 0.5, 0.1 and 0.05% potassium dichromate in all 8 patients. The photopatch test showed the same results. One patient was positive for 2% cobalt chloride and one for 5% nickel sulfate. Based on these data, it is important to consider the possibility of contact dermatitis due to a cellular phone, possibly caused by chromate, when the patients have erythema and papules on the hemilateral auricle or in the preauricular region.

VIII. Conclusions

• Both human and animal studies report large immunological changes with exposure to environmental levels of electromagnetic fields (EMFs). Some of these exposure levels are equivalent to those of e.g. wireless technologies in daily life.

• Measurable physiological changes (mast cells increases, for example) that are bedrock indicators of allergic response and inflammatory conditions are stimulated by EMF exposures.

• Chronic exposure to such factors that increase allergic and inflammatory responses on a continuing basis may be harmful to health.

• It is possible that chronic provocation by exposure to EMF can lead to immune dysfunction, chronic allergic responses, inflammatory responses and ill health if they occur on a continuing basis over time. This is an important area for future research.

• Specific findings from studies on exposures to various types of modern equipment and/or EMFs report over-reaction of the immune system; morphological alterations of immune cells; profound increases in mast cells in the upper skin layers, increased degranulation of mast cells and larger size of mast cells in electrohypersensitive individuals; presence of biological markers for inflammation that are sensitive to EMF exposure at non-thermal levels; changes in lymphocyte viability; decreased count of NK cells; decreased count of T lymphocytes; negative effects on pregnancy (uteroplacental circulatory disturbances and placental dysfunction with possible risks

to pregnancy); suppressed or impaired immune function; and inflammatory responses which can ultimately result in cellular, tissue and organ damage.
• Electrical hypersensitivity is reported by individuals in the United States, Sweden, Switzerland, Germany. Denmark and many other countries of the world. Estimates range from 3% to perhaps 10% of populations, and appears to be a growing condition of ill-health leading to lost work and productivity.
• The WHO and IEEE literature surveys do not include all of the relevant papers cited here, leading to the conclusion that evidence has been ignored in the current WHO ELF Health Criteria Monograph; and the proposed new IEEE C95.1 RF public exposure limits (April 2006).
• The current international public safety limits for EMFs do not appear to be sufficiently protective of public health at all, based on the studies of immune function. New, biologically-based public standards are warranted that take into account low-intensity effects on immune function and health that are reported in the scientific

Annexe 4 : s'il vous plait vous référer à la revue de Magda Havas présentée plus bas, et relatant une gamme d'effets des radio-fréquences sur la santé; document intidulé : ''*Expert Testimony prepared by Magda Havas, B.Sc.; Ph,D. Health Effects Associated with Radio Frequency Radiations*''

Annexe 5 : s'il vous plaît, vous référer au répertoire produit par le projet HESE-UK, mettant en relation différents seuils de puissance où des effets biologiques et de santé sont observés, aux seuils d'innocuité présumés par différentes juridiction. Document intitulé : ''*Power Density: Radio frequency Non-Ionizing Radiation*'' et trouvé plus bas.

Annexe 6 : Extraits d'une collection d'études portant sur les antennes de télécommunication, produites par Emfacts Consustancy. Le document de synthèse de cette collection, préparé par en 2006 Emfacts Consultency (2006) montrant ou non un effet biologique ou de santé par méthode d'investigation scientifique permet de mieux apprécier cette variabilité; s'il vous plaît, le considérer comme étant le document le plus important (et le plus succinct) de l'annexe 6; document intitulé : ''*Electro-magnetic fields & health : Over 900 published independent scientific studies*'' et trouvé plus bas. l'annexe 6 sert à montrer le grand nombre d'étude portant sur la question, ainsi que la variabilité (l'aspect contradictoire) des résultats de recherche expliquée ci-dessus par Belyaev et par Cherry.

Increased incidence of cancer near a cell-phone transmitter station

Wolf R, Wolf D.

Inter J Cancer Prev 1(2):123-128, 2004

http://electricwords.emfacts.com/wo224574.html

Significant concern has been raised about possible health effects from exposure to radiofrequency (RF) electromagnetic fields, especially after the rapid introduction of mobile telecommunication 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.

The few epidemiologic studies that did report on cancer incidence in relation to RF radiation have generally presented negative or inconsistent results, and thus emphasized the need for more studies that should investigate cohorts with high RF exposure for changes in cancer incidence.

The aim of this study is to investigate whether there is an increased cancer incidence in populations, living in a small area, and exposed to RF radiation from a cell-phone transmitter station.

This is an epidemiologic assessment, to determine whether the incidence of cancer cases among individuals exposed to a cell-phone transmitter station is different from tat expected in Israel, in Netanya, or as compared to people who lived in a nearby area.

Participants are people (n=622) living in the area near a cell-phone transmitter station for 3-7 years who were patients of one health clinic (of DW). The exposure began 1 year before the start of the study when the station first came into service. A second cohort of individuals (n=1222) who get their medical services in a clinic located nearby with very closely matched, environment, workplace and occupational characteristics was used for comparison.

In the area of exposure (area) eight cases of different kinds of cancer were diagnosed in a period of only one year. This rate of cancers was compared both with the rate of 31 cases per 10,000 per year in the general population and the 2/1222 rate recorded in the nearby clinic (area B). Relative cancer rates for female were 10.5 for area A. 0.6 for area B and 1 for the whole town of Netanya.

Cancer incidence of women in area A was thus significantly higher ($p<0.0001$) compared with that of area B and the whole city. A comparison of the relative risk revealed that there were 4.15 times more cases in area than in the entire population.

The study indicates an association between increased incidence of cancer and living in proximity to a cell-phone transmitter station.

Ecological study on residences in the vicinity of AM radio broadcasting

Sue Kyung Park, Mina Ha and Hyung-Jun Im

International Archives of Occupational and Environmental Health Published online: 31 July 2004

http://electricwords.emfacts.com/su201229.html

Ecological study on residences in the vicinity of AM radio broadcasting towers and cancer death: preliminary observations in Korea.

Objectives Public health concern about the health effects of radio-frequency electromagnetic fields (RF-EMFs) has increased with the increase in public exposure. This study was to evaluate some health effect of RF exposure by the AM radio broadcasting towers in Korea.

Methods We calculated cancer mortality rates using Korean death certificates over the period of 1994 1995 and population census data in ten RF-exposed areas, defined as regions that included AM radio broadcasting towers of over 100 kW, and in control areas, defined as regions without a radio broadcasting tower inside and at least 2 km away from the towers.

Results All cancers-mortality was significantly higher in the exposed areas [direct standardized mortality rate ratio (MRR) =1.29, 95%CI=1.12 1.49]. When grouped by each exposed area and by electrical power, MRRs for two sites of 100 kW, one site of 250 kW and one site of 500 kW, for all subjects, and for one site of 100 kW and two sites of 250 kW, for male subjects, showed statistically significant increases without increasing trends according to the groups of electric power. Leukemia mortality was higher in exposed areas (MRR=1.70, 95% CI=0.84 3.45), especially among young adults aged under 30 years (0 14 years age group, MRR=2.29, 95% CI=1.05 5.98; 15 29 age group, MRR=2.44, 95% CI=1.07 5.24) .

Conclusions We observed higher mortality rates for all cancers and leukemia in some age groups in the area near the AM radio broadcasting towers. Although these findings do not prove a causal link between cancer and RF exposure from AM radio broadcasting towers, it does suggest that further analytical studies on this topic are needed in Korea.

Study of the health of people living in the vicinity of mobile phone base stations: I. Influence of distance and sex

Santini R, Santini P, Danze JM, Le Ruz P, Seigne M

Pathol Biol (Paris) 50(6):369-373, 2002

http://electricwords.emfacts.com/sa172830.html

[Article in French]

A survey study using questionnaire was conducted in 530 people (270 men, 260 women) living or not in vicinity of cellular phone base stations, on 18 Non Specific Health Symptoms. Comparisons of complaints frequencies (CHI-SQUARE test with Yates correction) in relation with distance from base station and sex, show significant ($p < 0.05$) increase as compared to people living > 300 m or not exposed to base station, till 300 m for tiredness, 200 m for headache, sleep disturbance, discomfort, etc. 100 m for irritability, depression, loss of memory, dizziness, libido decrease, etc. Women significantly more often than men ($p < 0.05$) complained of headache, nausea, loss of appetite, sleep disturbance, depression, discomfort and visual perturbations.

This first study on symptoms experienced by people living in vicinity of base stations shows that, in view of radioprotection, minimal distance of people from cellular phone base stations should not be <

300 m.

Survey study of people living in the vicinity of cellular phone base stations.

Santini R, Santini P, Le Ruz P, Danze JM, Seigne M

Electromag Biol Med 22:41-49, 2003

http://electricwords.emfacts.com/sa186443.html

A survey study was conducted, using a questionnaire, on 530 people (270 men, 260 women) living or not in proximity to cellular phone base stations. Eighteen different symptoms (Non Specific Health Symptoms-NSHS), described as radiofrequency sickness, were studied by means of the chi-square test with Yates correction.

The results that were obtained underline that certain complaints are experienced only in the immediate vicinity of base stations (up to 10 m for nausea, loss of appetite, visual disturbances), and other at greater distances from base stations (u to 100 m for irritability, depressive tendencies, lowering of libido, and up to 200 m for headaches, sleep disturbance, feeling of discomfort). In the 200 m to 300 m zone, only the complaint of fatigue is experienced significantly more often when compared with subjects residing at more than 300 m or not exposed (reference group).

For seven of the studied symptoms and for the distance up to 300 m, the frequency of reported complaints is significantly higher ($P < 0.05$) for women in comparison to men. Significant differences are also observed in relation to the ages of subjects, and for the location of subjects in relation to the antennas and to other electromagnetic factors.

Incidence of cancer in the vicinity of Korean AM radio transmitters.

Ha M, Lim HJ, Cho SH, Choi HD, Cho KY

Arch Environ Health. 58(12):756-762, 2003

http://electricwords.emfacts.com/ha229073.html

Results of various studies have indicated a potential association between exposures to electrical and/or magnetic fields and risks of various cancers.

The authors used a cross-sectional ecological study design to investigate such a potential association. In areas proximate to 42 amplitude modulated (AM) radio transmitters, 11 high-power study sites (i.e., areas exposed to 100-1500-kW transmission power) and 31 low-power study sites (i.e., areas exposed to 50-kW transmission power) were identified.

The incidence of cancer within a 2-km radius of each transmitter was obtained from

- (a) Korean medical-insurance data for the years 1993 through 1996,
- (b) population census data for the year 1995, and
- (c) resident registration data for the year 1995.

The authors calculated age-standardized rate ratios for total cancer, leukemia, malignant lymphoma, brain cancer, and breast cancer, and compared the incidence of cancer within 2 km of the high-power transmitters vs. the incidence within 2 km of the low-power transmitters. Four control areas for each high-power transmitter were also selected. The control areas were located in the same, or nearest adjacent, province as the high-power sites, but were at least 2 km from any of the transmitters.

Indirect standardized observed/expected ratios for the high-power sites vs. control areas were calculated for each transmitter separately, and for 4 transmitter groupings defined by power level (i.e., 100 kW, 250 kW, 500 kW, and 1500 kW).

The authors found no significant increase in age-standardized rate ratios of cancers for high-power vs. low-power sites, with the exceptions of total cancer and of brain cancer in women. Among the 11 high-power sites, there were significantly increased incidences of leukemia in 2 areas and of brain cancer in 1 area.

Future studies should incorporate additional detailed exposure assessments and a strong analytical study design to explore the possible association between radiofrequency radiation from AM radio transmitters and cancer.

The Microwave Syndrome: A Preliminary Study in Spain

Navarro EA, Segura J, Portolés M, Gómez-Perretta de Mateo C

Electromag. Biol. Med. 22:161-169, 2003

http://electricwords.emfacts.com/na212839.html

A health survey was carried out in Murcia, Spain, in the vicinity of a Cellular Phone Base Station working in DCS-1800 MHz. This survey contained health items related to ³microwave sickness² or ³RF syndrome.²

The microwave power density was measured at the respondents' homes. Statistical analysis showed significant correlation between the declared severity of the symptoms and the measured power density. The separation of respondents into two different exposure groups also showed an increase of the declared severity in the group with the higher exposure.

Risk of leukemia in residences near a radio transmitter in Italy.

Michelozzi P, Ancona C, Fusco D, Forastiere F, Perucci CA

Epidemiology 9 (Suppl) 354p, 1998

http://electricwords.emfacts.com/mi30184.html

We conducted a small area study to investigate a cluster of leukemia near a high power radio-transmitter in a peripheral area of Rome. The leukemia mortality within 3.5 km (5,863 inhabitants) was higher than expected (SMR=2.5, 95% confident interval 1.07-4.83); the excess was due to a

significant higher mortality among men (7 cases observed, SMR=3.5).

The results of the Stone's test, after adjusting for socio-economic confounding, showed a significant decline in risk with distance from the transmitter only among men (p=0.005), whereas the p-value for both sexes was p=0.07.

Cancer incidence near radio and television transmitters in Great Britain. II. All high power transmitters.

Dolk H, Elliott P, Shaddick G, Walls P, Thakrar B,

Am J Epidemiol 145(1):10-17, 1997

http://electricwords.emfacts.com/do83554.html

All high power transmitters. Am J Epidemiol 145(1):10-17, 1997. A small area study of cancer incidence, 1974-1986, near 20 high power television (TV) and frequency modulation (FM) radio transmitters in Great Britain was carried out to place in context the findings of an earlier study around the Sutton Coldfield transmitter. The national database of postcoded cancer registrations was used with population and socioeconomic data from the 1981 census.

Cancers examined were adult leukemias, skin melanoma, and bladder cancer, following the findings in the earlier study of significant declines in risk of these cancers with distance from the Sutton Coldfield transmitter. Childhood leukemia and brain cancer were also examined. Statistical analysis was performed for all transmitters combined, four overlapping groups of transmitters defined by their transmission characteristics, and for all transmitters separately. There were 3,305 adult leukemia cases from 0-10 km (observed/expected (O/E) ratio = 1.03, 95% confidence interval (CI) 1.00-1.07).

A decline in risk of adult leukemia was found for all transmitters combined (p = 0.05), two of the transmitter groups, and three of the single transmitters; for all transmitters combined, observed excess risk was no more than 15% at any distance up to 10 km, and there was no observed excess within 2 km of transmitters (O/E ratio = 0.97, 95% CI 0.78-1.21). For childhood leukemia and brain cancer, and adult skin melanoma and bladder cancer, results were not indicative of a decline in risk with distance from transmitters.

The magnitude and pattern of risk found in the Sutton Coldfield study did not appear to be replicated. The authors conclude that the results at most give no more than very weak support to the Sutton Coldfield findings.

Semen analysis of personnel operating military radar equipment.

Hjollund NH, Bonde JP, Skotte J,

Reprod Toxicol 11(6):897, 1997

http://electricwords.emfacts.com/hj101235.html

This is a preliminary survey of semen quality among Danish military personnel operating mobile ground-to-air missile units that use several microwave emitting radar systems. The maximal mean exposure was estimated to be 0.01 mW/cm^2. The median sperm density of the military personnel was significantly low compared to the references.

The difference is either due to chance, uncontrolled bias, or nonthermal effects of transitory microwaves.

Cancer incidence and mortality and proximity to TV towers

Hocking B, Gordon IR, Grain HL, Hatfield GE,

Med J Aust 165(11-12):601-605, 1996

http://electricwords.emfacts.com/ho37303.html

(Published erratum appears in Med J Aust 166(2):80, 1997.)

OBJECTIVE: To determine whether there is an increased cancer incidence and mortality in populations exposed to radiofrequency radiations from TV towers.

DESIGN: An ecological study comparing cancer incidence and mortality, 1972-1990, in nine municipalities, three of which surround the TV towers and six of which are further away from the towers. (TV radiofrequency radiation decreases with the square of the distance from the source.) Cancer incidence and mortality data were obtained from the then Commonwealth Department of Human Services and Health. Data on frequency, power, and period of broadcasting for the three TV towers were obtained from the Commonwealth Department of Communications and the Arts. The calculated power density of the radiofrequency radiation in the exposed area ranged from 8.0 microW/cm2 near the towers to 0.2 microW/cm2 at a radius of 4km and 0.02 microW/cm2 at 12 km.

SETTING: Northern Sydney, where three TV towers have been broadcasting since 1956.

OUTCOME MEASURES: Rate ratios for leukaemia and brain tumour incidence and mortality, comparing the inner with the outer areas. RESULTS: For all ages, the rate ratio for total leukaemia incidence was 1.24 (95% confidence interval [CI], 1.09-1.40). Among children, the rate ratio for leukaemia incidence was 1.58 (95% CI, 1.07-2.34) and for mortality it was 2.32 (95% CI, 1.35-4.01). The rate ratio for childhood lymphatic leukaemia (the most common type) was 1.55 (95% CI, 1.00-2.41) for incidence and 2.74 (95% CI, 1.42-5.27) for mortality. Brain cancer incidence and mortality were not increased.

CONCLUSION: We found an association between increased childhood leukaemia incidence and mortality and proximity to TV towers

Decreased survival for childhood leukaemia in proximity to TV towers.

Hocking B, Gordon I,

Presented at the Annual Scientific Meeting of the Royal Australasian College of Physicians in Adelaide, SA, 2-5 May 2000

http://electricwords.emfacts.com/ho32266.html

Objective: In a previous study we reported an increased risk of childhood leukaemia in municipalities proximate to TV towers in north Sydney compared with more distant ones (Hocking B Gordon I Hatfield G Grain H. Cancer incidence and proximity to TV towers Med J Aust 1996; 165: 601-605). The rate ratio for incidence, comparing the inner ring of municipalities to the outer ring, was 1.55 (95% confidence interval 1.00 - 2.41) and for mortality the rate ratio was 2.74 (95% confidence interval 1.42 - 5.27).

The objective of the current study was to analyse the survival experience of the cases in detail, to determine whether there are differences between the two populations.

Design and Outcome Measures: Survival data on cases diagnosed from 1972-93 were analysed. Data on all cases who survived for less than one month were verified by the NSW cancer registry and one case diagnosed at autopsy excluded. Data were described by Kaplan-Meier curves. The log-rank and Wilcoxon tests were used to compare the two groups. Cox's proportional hazards model was used to adjust for confounders.

Results: There were 123 diagnosed cases of acute lymphatic leukaemia (ICD-9 204.0) of which 29 (16 deaths) were in the inner ring of municipalities and 94 (34 deaths) were in the outer ring. We found a significant difference in survival (log rank: P = 0.03; Wilcoxon: P = 0.05). The 5 year survival in the inner ring of municipalities was 55% and in the outer ring 71% (inner 23% worse); at 10 years the survival was 33% and 62% respectively (inner 47% worse). After adjustment for the potential confounders using Cox's model, the mortality rate ratio comparing the inner ring with the outer ring was found to be 2.1 (95% confidence interval: 1.1 - 4.0). We were not able to control for cytogenetic abnormalities.

Conclusion: There was an association between proximity to the TV towers and decreased survival, among cases of childhood leukaemia.

Melanoma incidence and frequency modulation (FM) broadcasting.

Hallberg O, Johansson O.

Arch Environ Health. 57(1):32-40, 2002

http://electricwords.emfacts.com/ha211176.html

The incidence of melanoma has been increasing steadily in many countries since 1960, but the underlying mechanism causing this increase remains elusive. The incidence of melanoma has been linked to the distance to frequency modulation (FM) broadcasting towers.

In the current study, the authors sought to determine if there was also a related link on a larger scale for entire countries.

Exposure-time-specific incidence was extracted from exposure and incidence data from 4 different countries, and this was compared with reported age-specific incidence of melanoma. Geographic differences in melanoma incidence were compared with the magnitude of this environmental stress. The exposure-time-specific incidence from all 4 countries became almost identical, and they were

approximately equal to the reported age-specific incidence of melanoma.

A correlation between melanoma incidence and the number of locally receivable FM transmitters was found. The authors concluded that melanoma is associated with exposure to FM broadcasting.

Mobile phone base stations and adverse health effects: phase 2 of a cross-sectional study with measured radio frequency electromagnetic fields.

Berg-Beckhoff G, Blettner M, Kowall B, Breckenkamp J, Schlehofer B, Schmiedel S, Bornkessel C, Reis U, Potthoff P, Schuz J

Occup Environ Med 66:124-130, 2009

http://electricwords.emfacts.com/be360290.html

Objective: The aim of the cross-sectional study was to test the hypothesis that exposure to continuous low-level radio frequency electromagnetic fields (RF-EMFs) emitted from mobile phone base stations was related to various health disturbances.

Methods: For the investigation people living mainly in urban regions were selected from a nationwide study in 2006. In total, 3526 persons responded to a questionnaire (response rate 85%).

For the exposure assessment a dosimeter measuring different RF-EMF frequencies was used. Participants answered a postal questionnaire on how mobile phone base stations affected their health and they gave information on sleep disturbances, headaches, health complaints and mental and physical health using standardised health questionnaires. Information on stress was also collected. Multiple linear regression models were used with health outcomes as dependent variables (n=1326).

Results: For the five health scores used, no differences in their medians were observed for exposed versus nonexposed participants. People who attributed adverse health effects to mobile phone base stations reported significantly more sleep disturbances and health complaints, but they did not report more headaches or less mental and physical health. Individuals concerned about mobile phone base stations did not have different wellbeing scores compared with those who were not concerned.

Conclusions: In this large population-based study, measured RF-EMFs emitted from mobile phone base stations were not associated with adverse health effects.

Annexe 7 : étude documentaire scientifique montrant le biais de financement et de publication des études portant sur les effets sanitaires des radiofréquences; intitulée : '' *Source of Funding and Results of Studies of Health Effects of Mobile Phone Use: Systematic Review of Experimental Studies* ''; et trouv□ plus bas.

Annexe 8 : article journalistique intitulé : '' *Téléphonie mobile : Trafic d'influence à l'OMS?* '', visant à exposer le biais de financement et le biais de sélection et

trouvé plus bas.

Annexe 9 : manifeste d'une des nombreuses résolutions de professionnels, ayant motivé des juridictions comme Parlement européen (Conseil de l'Europe cité au mémoire) à adopter le principe de précaution en gestion des antennes. Intitulé : ''*Appel de Fribourg*'' et trouvé en fin de page.

Annexe 4

Magda Havas, B.Sc., Ph.D.
Environmental & Resource Studies
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Date: October 10, 2005
For: Courtesy Public Hearing for Z-01-05
Exhibit for Mt. Ulla, North Carolina Hearing, October 13, 2005

Expert Testimony prepared by Magda Havas, B.Sc., Ph.D.
Health Effects Associated with Radio Frequency Radiation

Introduction

Our use of radio frequency radiation started with the invention of the radio that allowed wireless communication at great distances. During World War II, the higher end of the radio frequency spectrum was used for radar. After the war, television and then mobile telecommunications technology (i.e. pagers) became popular followed by the most recent revolution of the cellular phone industry.

Today, more than at any other time in history, this planet is being inundated by radio frequency radiation from man-made sources. The electromagnetic energy is used to send voice and visual messages within frequency bands that range from thousands (kilo-Hertz, kHz) to billions (giga-Hertz, GHz) of cycles per second. Currently there is no international consensus on exposure guidelines, which range orders of magnitude in various countries around the world.

Exposure to radar installations was a concern in the 1950s until the 1980s and interest in this area has been reignited because of our growing reliance on cell phones and the need for more antennas and base stations. Research on the health effects associated with exposure to radio frequency radiation from antennas is at an early stage of development. However, results from many of the studies that have examined adverse health effects for residents living near antennas are alarming.

For my expert testimony I propose to introduce scientific studies of exposure to broadcast antennas (both TV and radio), military radio frequency installations, mobile phone antennas, as well as other studies that indicate adverse health effects of radio frequency radiation. I also propose to introduce a medical condition, known as electrohypersensitivity (EHS) that is

becoming increasingly common and appears to be related to exposure to radio frequency radiation (RFR) at levels well below existing guidelines.

Summary

Biological effects of radio frequency radiation have been document and range from cancers to cognitive disorders and sleeping dysfunction among humans and abnormal behavior, reduced milk yield, miscarriages and premature death among farm animals. People who live near broadcast antennas and cell phone antennas have a higher risk of developing leukemia. An increasing number of individuals are also becoming sensitive to this form of radiation and exhibit signs of *electrohypersensitivity* (EHS), which has been recognized as a disability in Sweden. This illness appears to be increasing and may already affect approximately 35% of the population according to one estimate in the United Kingdom.

Local governing bodies need access to this scientific information so they can make intelligent decisions regarding placement of these antennas. It is critical that antennas not be placed near residential areas and near schools since children seem to be particularly vulnerable to this form of energy. Farm animals are also sensitive and exposure can result in economic hardship to farmers in the form of sick animals and reduced milk production. For broadcast antennas the critical distance appears to be around 4 km.

Neither Canada nor the United States has non-thermal guidelines for RFR and the existing thermal guidelines do not protect the public. The Public Health Office of the government of Salzburg recommended that levels for the sum total of all antennas at a particular site not exceed a power density of 1 microwatt/m^2 (0.0001 microwatts/cm^2.). Until new guidelines are introduced in North America the Precautionary Principle needs to be applied to minimize exposure.

Currently we are conducting a human experiment on a massive scale by exposing a large population worldwide to radio frequency radiation without understanding the long-term biological and health consequences.

Broadcast Antennas

Broadcast antennas differ from cell phone antennas in that the transmitting frequency is lower, the radiation is stronger and transmission is more consistent with a broadcast antenna. However, in both cases, surrounding populations are exposed to radio frequency radiation and the biological results are similar although the distances, within which effects are documented, differ.

Example #1: Study of Health Effects of the Shortwave Transmitter Station of Schwarzenburg, Berne, Switzerland. **[Altpeter et al. 1995. Federal Office of Energy, BEW Publication Series, Study No. 55].**

Residents living near a shortwave transmitter station in Switzerland began to complain about ill health in the 1970s. In 1990, the Federal Department of Traffic and Energy, the licensing authority, commissioned a health study of the residents. Two zones were identified that decreased in distance and exposure to RFR and these were compared with reference zone C. Those who lived closest to the transmitter (zone A) had the highest incidence of sleeping disorders, restlessness, pain, weakness, fatigue, constipation and disturbed concentration.

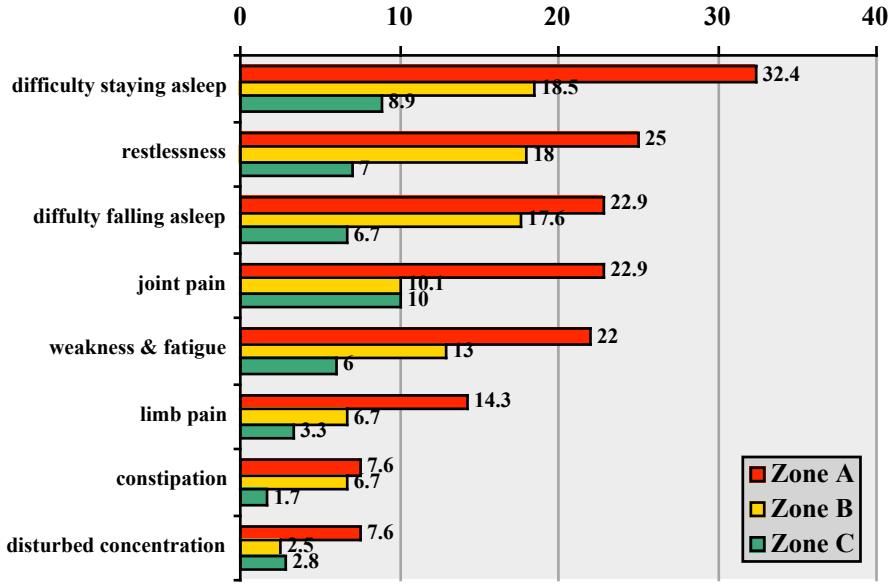

Figure 1. Response of residents living near a shortwave transmitter station near Schwarzenburg, Switzerland (Altpeter et al. 1995).

During the course of this research the transmitter failed for 3 days and during that period individuals experienced improved sleep that was detected after a 1-day delay. Since neither the researchers nor the residents were aware of this malfunction it demonstrates a biological rather than a psychological response to the transmitters.

Additional analyses showed an increased incidence of cancers (62% increase); diabetes (90% increase) and psychosis (3.8 fold increase) for those living near the transmitter.

Studies of two schools, one exposed and the other a reference school found reduced academic performance among the students in the school exposed to RFR.

Summary: People living within zone A and B experienced symptoms of electrohypersensitivity, had a higher incidence of cancers, diabetes and psychosis, and children exposed to this radiation had poorer academic performance.

Example #2: Cancer Incidence & Mortality & Proximity to TV Towers.
[Hocking et al. 1996. Med. J. Aust. 165(11-12):601-605.]

In North Sidney, Australia, both adults and children who lived within 4 km of a TV tower had

higher incidence of leukemia. For adults it was a 24% increase and for children it was a 58% with a 2.3 fold increase in mortality. All of these were statistically significant. Radio frequencies ranged from 8 to 0.2 microwatts/cm^2 within a 4 km radius of the tower and decreased to 0.02 microwatts/cm^2 at 12 km for the reference population.

Example #3: Risk of leukemia and residence near a radio transmitter in Italy. [Michelozzi et al. 1998. Epidemiology 9 (Suppl): 354.]

Adults who lived within 3.5 km radius of a radio transmitter near Rome Italy had a 2.5-fold elevated mortality rate (SMR[1] 2.5, 1.07-4.83 95% CI) associated with leukemia. The risk significantly declined with distance from the transmitter for men (P=0.005).

Example #4: Extraordinary behavior disorders in cows in proximity to transmission stations. [Loscher and Kas. 1998. Der Pratische Tierarz 79:5:437-444, translated from German.]

A cellular phone transmission antenna was installed on a tower with a pre-existing TV transmission antenna on a farm in Germany. After this new installation the cows produced less milk, miscarried, developed health problems, and exhibited unusual behavior that included conjunctivitis, repetitive head motion, reduced grazing in the field, and rapid deterioration after the third or forth calving which lead to premature death.

Food quality was high and could not account for the metabolic disturbances. The increased miscarriages did not related to either viral or bacterial infection. Autopsies indicated acute heart and circulatory problems with internal bleeding in several organs. This is consistent with microwave exposure.

Measurements of radio frequency radiation ranged from 400 to 936 MHz and the highest power density recorded was 7 milliwatts/m^2, well below international guidelines.

One cow with abnormal head movements was moved to a farm 20 km away and the head movements disappeared within 5 days. When this animal was returned to its home farm the abnormal head movements returned with a few days.

In a similar study of cows on a farm close to a transmission station, the micronuclei in cow blood were elevated indicating a genotoxic effects of exposure (Balode 1996, cited in Loscher and Kas 1998).

[1] SMR = standard mortality rate; CI = confidence interval

Example #5: Cancer rate and FM TV in Sweden.

Cancer mortality and long term sick leave

(Translated by Ö Hallberg from the original article "Cancerdödlighet och långtidssjukskrivning", Medikament 1-02; 40-41 in Swedish by Ö Hallberg and Olle Johansson, Assoc. Professor, Experimental Dermatology, Institution of Neuroscience, Karolinska Institute, Sweden).

The figure below shows that the cancer rate in Sweden began to increase when FM television was introduced in the late 1950s and it has continued to rise until the present period.

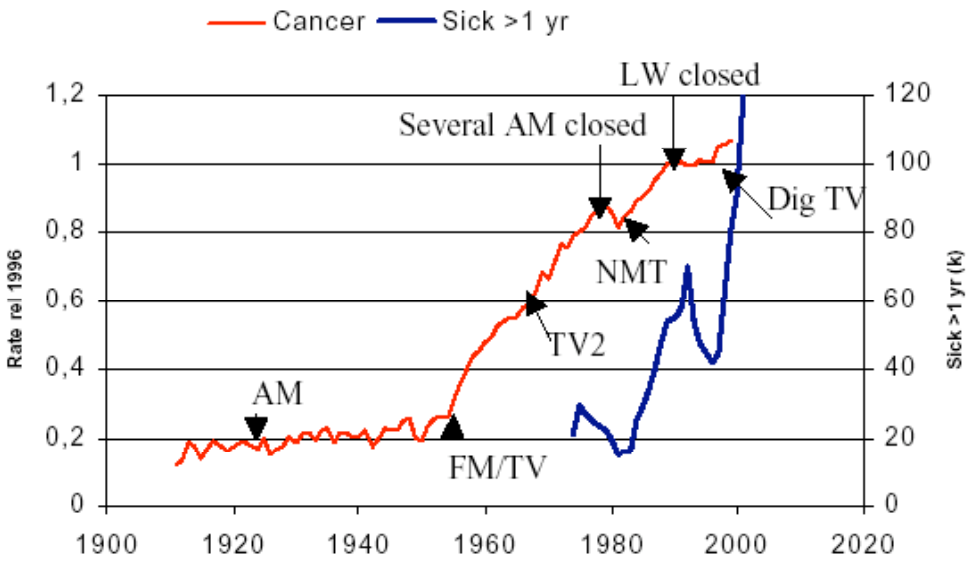

Figure 2. Normalized cancer-rate (see text) and the number of people who have been sick for more than one year in Sweden. The sharp reduction of the number of long-term sick registered in 1993 has been connected to increased possibilities of early retirement from that year.

Summary: What these studies show is that humans who live within 4 km of a broadcast antenna experience behavioral disorders, cognitive dysfunction, and adverse health effects including leukemia, diabetes, psychoses. Dairy cows provide less milk, miscarry, show abnormal behavior, and die prematurely when they live near a radio frequency antennas.

Radio Frequency Radiation and Microwave Radiation and Military Personnel

Example #6: Cancer morbidity in subjects occupationally exposed to high frequency (radio frequency and microwave) electromagnetic radiation. Szmigielski (1996).

Exposure of military personnel to radio frequency radiation and to microwaves has been associated with an increased incidence of various types of cancer as shown in the tables below. Cancers that show statistically significant increases include: nervous system and brain tumors

(91% increase); colorectal cancer (3.19-fold increase); esophageal and stomach cancer (3.24-fold increase); and blood forming and lymphatic cancers (6.31-fold increase).

For the blood forming and lymphatic cancers, chronic myeloblastic leukemia had the highest relative risk (13.9-fold increase), followed by acute myeloblastic leukemia (8.62-fold increase); non-Hodgkin lymphoma (5.82-fold increase) and acute lymphoblasic leukemia (5.82-fold increase).

Table 1.

Table: Incidence of neoplasms (per 100,000 subjects annually) in military personnel exposed and non-exposed (control) to radiofrequency and microwave radiation, Szmigielski (1996).

Localization of malignancies	Incidence (Expected)	Incidence (Exposed)	Risk Ratio	95% CI limits	p-value
Pharynx	1.96	2.12	1.08	0.82-1.24	N.S.
Esophageal and stomach	4.83	15.64	3.24	1.85-5.06	<0.01
Colorectal	3.96	12.65	3.19	1.54-6.18	<0.01
Liver, pancreas	2.43	3.58	1.47	0.76-3.02	N.S.
Laryngeal, lung	21.89	23.26	1.06	0.72-1.56	N.S.
Skin, including melanomas	3.28	5.46	1.67	0.92-4.13	<0.05
Nervous system including brain tumour	2.28	4.36	1.91	1.08-3.47	<0.05
Thyroid	1.38	2.12	1.54	0.82-2.59	N.S.
Haematopoietic system and lymphatic organs	6.83	43.12	6.31	3.12-14.32	<0.001
All malignancies	57.60	119.12	2.07	1.12-3.58	<0.05

Table 2.

Table: Incidence of haemopoietic and lymphatic malignancies (per 100,000 subjects annually) in military personnel exposed and non-exposed (control) to radiofrequency and microwave radiation.

Type of malignancy	Incidence Non-exposed	Incidence Exposed	RR	95 % Confid.	Significance
Hodgkin's disease	1.73	5.12	2.96	1.32 - 4.37	<0.05
Lymphoma (non-Hodgkin and lymphosarcoma	1.82	10.65	5.82	2.11 - 9.74	<0.001
Chronic lymphacytic leukaemia	1.37	5.04	3.68	1.45 - 5.18	<0.01
Acute lymphoblastic leukaemia	0.32	1.84	5.75	1.22 - 18.16	<0.05
Chronic myelocytic leukaemia	0.88	12.23	13.90	6.72 - 22.12	<0.001
Acute myeloblastic leukaemia	0.71	6.12	8.62	3.54 - 13.67	<0.001
Total	6.83	43.12	6.31	3.12 - 14.32	<0.001

Exposure of military personnel to radio frequency and microwave radiation is likely to be much higher than exposure of populations to RFR around a broadcast antenna. However, both

exposure result in an increased risk of cancers and this should provide a warning regarding the placement of broadcast antennas.

Mobile Phone Antennas

Cell phone antennas use a higher frequency than broadcast antennas and their radiation is normally intermittent and at a lower intensity than broadcast antennas. Despite this studies in various countries are documenting adverse health effects for people who live near cell phone antennas. According to Dr. Gahame Blackwell, as of Feb 2005 all five epidemiological studies of people who live near such installations show ill health effects from the masts. These include studies in Spain, Netherlands, Israel and Germany. Three of those studies are presented below:

Example #7: Symptoms experience by people in the vicinity of cellular phone base station. [Santini 2001, La Presse Medicale]

In this study the people who lived closest to the cellular antennas had the highest incidences of the following disorders: fatigue, sleep disturbances, headaches, feeling of discomfort, difficulty concentrating, depression, memory loss, visual disruptions, irritability, hearing disruptions, skin problems, cardiovascular disorders, and dizziness (See Figure 3).

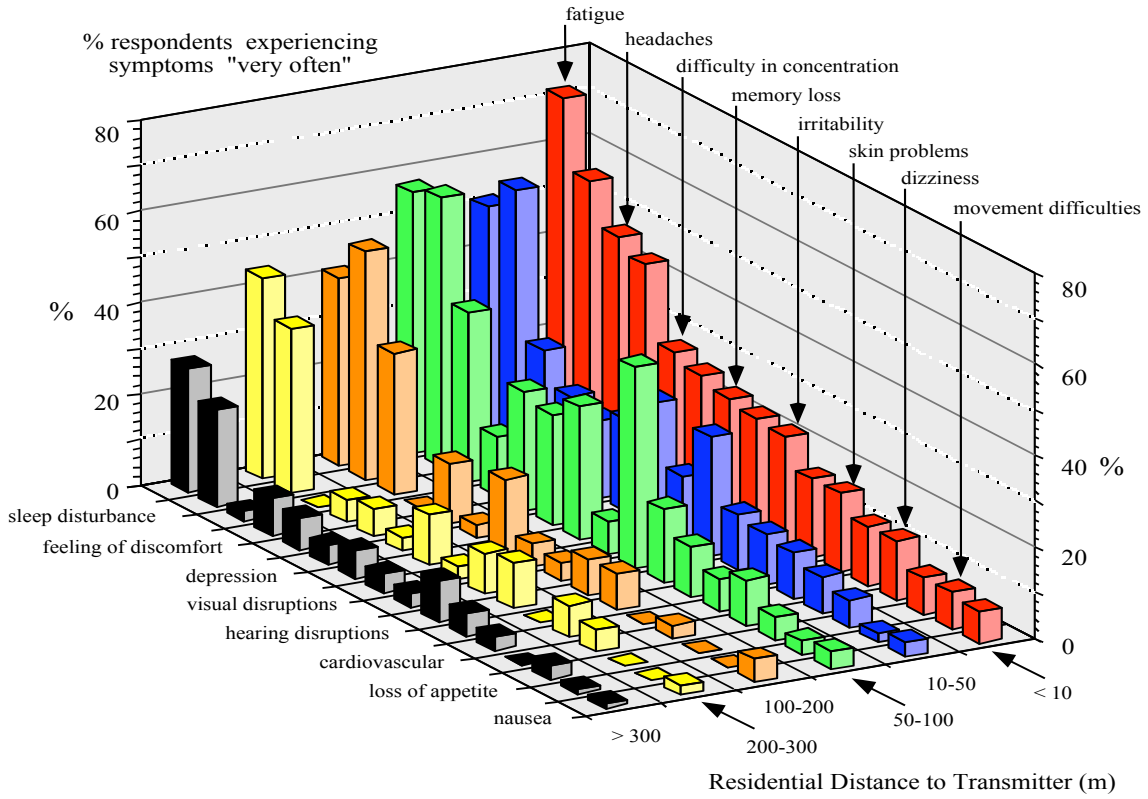

Figure 3. Response of residents living in the vicinity of a cellular phone base station in Spain (Santini 2001).

Adverse health effects were reported at distances up to 300 meters. In this case, health is defined according to the World Health Organization definition as "*the state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity*".

Example #8: The Microwave Syndrome: A Preliminary Study in Spain.
[Navarro,E.A., J. Segura, M. Portoles, C. G-P de Mateo. 2003. Electromagnetic Biology & Medicine Vol. 22 (2):161-169.]

In Murcia Spain, scientists conducted a health survey near a cellular phone base station. Measurements of power density were below guidelines in both exposed and reference populations. Exposed individuals lived within 50 and 150 meters of the base station and the reference population lived 260 to 308 meters away. Exposed residents experienced more headaches, sleep disturbances, irritability, difficulty concentrating, discomfort, dizziness, appetite loss and nausea, symptoms that are typical of electrohypersensitivity syndrome. These results are similar to those reported in Study #1, (see Table 3).

Table 3. Response of residents living near a cellular phone base station in Spain (Navarro et al. 2003).

	Exposed	**Reference**	**P-value**
Respondents	54	47	–
Distance to Base Station	50 to 150 m	260 to 308 m	< 0.001
Average Power Density (mW/cm^2)	0.11 $\pm$ 0.19	0.01 $\pm$ 0.04	< 0.001
Headache	2.17	1.53	<0.001
Sleep disturbance	1.94	1.28	<0.01
Irritability	1.56	1.04	<0.05
Difficulty concentrating	1.56	1.00	<0.02
Discomfort	1.41	0.87	<0.02
Depression	1.30	0.74	<0.02
Dizziness	1.26	0.74	<0.05
Appetite loss	0.96	0.55	<0.05
Nausea	0.93	0.53	<0.05

0 = never; 1 = sometimes; 2 = often; 3 = very often

Example #9: Naila Study, Germany (November 2004); Report by five medical doctors.

The aim of this study was to examine whether people living close to cellular transmitter antennas were exposed to a heightened risk of taking ill with malignant tumours. What the researchers found was that the proportion of newly developing cancer cases was significantly higher among those patients who had lived during the past ten years at a distance of up to 400 metres from the cellular transmitter site, which bas been in operation since 1993, compared to those patients living further away, and that the patients fell ill on average 8 years earlier. After five years' operation of the transmitting installation, the relative risk of getting cancer had trebled for the residents of the area in the proximity of the installation compared to the inhabitants of Naila outside the area.

Example #10: RF radiation-induced changes in the prenatal development of mice. [Magras, 1997. Bioelectromagnetics 18(6):455-461.]

In an experiment, 12 pairs of mice (6 reference pairs) and (6 exposed pairs) were exposed to the radiation from an antenna park where levels were in the order of 1.053 to 0.168 microW/cm^2. Mice were mated 5 times and resulted in a total of 118 newborn offspring. The number of newborns per dam significantly decreased for mice exposed to the radio frequency radiation resulting in irreversible infertility.

What these studies show is that animals and humans who live within 300 to 400 meters of a cell phone transmission antenna experience behavioral disorders and adverse health effects.

These studies collectively show that there is an increased incidence of diabetes, psychosis, sleeping disturbances, depression, pain, fatigue, memory loss, impaired balance, reduced milk yield (cattle), and reproductive impairment (cattle and mice). The critical distances appear to be around 400 m from cell phone antennas and about 4 km from broadcast antennas (Table 4). More research is needed to determine these distances more accurately.

Table 4. Summary of Examples 1 to 10 provided in this testimony.

#	Source: Location	Power Density (microW/cm^2)	Distance	Effects	Reference
1	Shortwave Switzerland	Below guidelines 3 to 41 mA/m 1-2 mA/m (guideline=73 mA/m)	No data Zone A & B Zone C (reference)	Sleep disorder Restlessness Pain Weakness & fatigue Constipation Difficulty concentrating Cancer Diabetes Psychoses Poor academic performance	Altpeter et al. 1995
2	TV Tower Australia	8 0.2 0.02	Near 4 km 12 km	Leukemia incidence higher	Hocking et al. 1996
3	Radio Tower Italy	Below guidelines	3.5 km	Leukemia mortality higher (2.5 fold)	Michelozzi et al. 1998
4	TV & Cell Phone Germany	Max: 0.7	Adjacent to farm	Cows: Miscarriage Reduced milk yield Premature death Abnormal behavior	Loscher and Kas 1998
5	FM TV Sweden	No data	No data	Increased cancer rate	Hallberg and Johansson 2004
6	RFR & Microwave	Exposed vs not exposed	No data	Increase in various cancers Leukemias, Lymphomas, Esophageal Stomach Colorectal Nervous system Brain	Szmigielski 1996
7	Cell Phone Spain	Below guidelines	300 m	EHS: Fatigue Headaches, Cognitive disorders Depression, Visual and hearing disruptions, Cardiovascular problems Skin disorders Dizziness	Santini et al. 2001
8	Cell Phone Spain	0.11 $\pm$ 0.19 0.01 $\pm$ 0.04	50-150 m 260-308 m	EHS: Headache, Sleep disturbance Irritability Difficulty concentrating Depression Dizziness Loss of appetite	Navarro et al. 2003
9	Cell Phone Germany	Below guidelines	400 m	After 5 years a 3-fold increase in cancer incidence	Naila Study, 2004
10	Antenna Park	1.053-0.168	No data	Infertility in mice experimentally exposed for 5 gestations	Magras 1997

Placement of Cell Phone Antennas:

Even though cell phone antennas are unlikely to be as harmful as broadcast antennas, based on the studies previously mentioned, many jurisdictions worldwide are struggling with siting of cell phone base stations.

Example #11: The International Association of Fire Fighters (IAFF) ratified Resolution 15 in Boston, August 2004. Resolution 15 states that "*The IAFF oppose the use of fire stations as base stations for antennas and towers for the conduction of cell phone transmissions until such installations are proven not to be hazardous to the health of our members*." Evidence in California indicates that fire fighters in a fire hall with a cell phone antenna on the roof have abnormal brain activity.

Example #12: In Toronto as of 2000 there were more than 10,000 antennas in the City. The Toronto Health Department, concerned about this proliferation, requested that "applicants who wish to install new, replacement or modified antennas demonstrate that radio frequency exposures in the areas where people other than telecommunications workers would normally use will be at least 100 times lower than those currently recommended by Safety Code 6." This would reduce guidelines from 200-1000 mW/cm^2 (Canada) to 2-10 mW/cm2 (Toronto). *[Ronald Macfarlane, Health Concerns of Radio Frequency Fields near Base Telephone Transmission Towers. Toronto Public Health, Health Promotion and Environmental Protection Office, November 1999.]*

Example #13: Belfast City Council Ratified decisions of its Development Committee (Aug 18, 1999) that no transmitter masts should be permitted on any Council Property, due to unknown risk and substantial public concern.

Example #14: Wyre Borough Council, Lancashire believed it was unsuitable to site telecommunication towers 190 m from primary school and 40 m from houses.

Example #15: Scotland Planning Authorities adopted "Precautionary Policy" due to "perceived inadequate official advice from Government Departments"

Example #16: In England & Wales, the Local Government Association (LGA) advised member authorities to adopt "Precautionary Approach". This decision making process was based on the concept that waiting for "conclusive scientific evidence" before acting is potentially flawed.

If siting of cell phone antennas has received so much attention and concern, at least the same amount of concern, if not more, is required for siting of broadcast antennas.

Other Evidence that Radio Frequency Radiation is Harmful.

Example #17: In vivo Experiments

A number of laboratory studies with rodents support the claim that RFR is genotoxic. Lai and Singh (2005) reported single- and double-strand breaks in the brains cells of microwave-exposed

rats (at cell phone frequencies of 2450 MHz, continuous wave) compared with sham-exposed animals. *[Lai and Singh. 2005. Interaction of Microwaves and a Temporally Incoherent Magnetic Field on Single and Double DNA Strand Breaks in Rat Brain Cells. Electromagnetic Biology and Medicine (formerly Electro- and Magnetobiology) Volume 24, Number 1 / 2005 Pages: 23 - 29]*

Example 18: Radio frequency on indoor wires and health effects.

We normally assume that radio frequency travels only through the air since it is a "wireless" form of energy. However, any conducting object can act like an antenna and pick up RFR. Stetzer and Havas (2005) were able to detect RFR coming from a radio station (MHz range) in Bermuda that came in through the electrical wire attached to a brass lamp. The lamp then reradiated this frequency, which was also measured on a nearby bed (metal bedsprings) and was absorbed by anyone sitting or standing close to the lamp or touching the bed. This form of energy induces symptoms of electrical hypersensitivity.

Example #19: A Review of the Potential Health Risks of Radiofrequency Fields from Wireless Telecommunication Devices 1999. An Expert Panel Report prepared at the request of The Royal Society of Canada for Health Canada

According to this expert panel there is a growing body of scientific evidence which suggests that exposure to RF fields at intensities far less than levels required to produce measurable heating can cause effects in cells and tissues. These biological effects include alterations in the activity of the enzyme ornithine decarboxylase (ODC), in calcium regulation, and in the permeability of the blood-brain barrier. Some of these biological effects brought about by non-thermal exposure levels of RF could potentially be associated with adverse health effects.

Electrohypersensitivity (EHS)

Example #20: One of the most famous people who have become hypersensitive to radio frequency radiation is Gro Harlem Brundtland, the former Prime Minister of Norway. Dr. Brundtland develops headaches when she uses a cell phone and can no longer use one. She even develops headaches when people within 4 meters (12 feet) of her have a cell phoned turned on but not in use. . *[Mobile phone radiation gives Gro Harlem Brundtland headaches. Translation from Norwegian "Dagblad et" March 9, 2002, by Aud Dalsegg.].*

Electrohypersensitivity (EHS) is now recognized by the World Health Organization (WHO) and is defined as:

> *". . . a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs). . . Whatever its cause, EHS is a real and sometimes a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards.* [WHO International Seminar and Working Group meeting on EMF Hypersensitivity, Prague, October 25-27, 2004].

EHS is classified as a disability in Sweden. As many as 35% of the population may be sensitive to electromagnetic energy and this syndrome may be increasing. Symptoms include: cognitive dysfunction (memory, concentration, problem-solving); balance, dizziness & vertigo; facial flushing, skin rash; chest pressure, rapid heart rate; depression, anxiety, irritability, frustration, temper; fatigue, poor sleep; body aches, headaches; ringing in the ear (tinnitus) and are consistent with chronic fatigue and fibromyalgia.

Precautionary Principle

Until appropriate guidelines can be introduced a number of international and national agencies, including the US National Institute of Environmental Health Sciences, are recommending adoption of the Precautionary Principle that was presented at the Rio Conference on Environment and Development in Brazil in 1992.

The Precautionary Principle (PP) states that: *"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capability. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."*

The overarching Considerations include:

1. Scientific Basis for Application
2. Transparency, Accountability & Public Involvement
3. Cost-Effectiveness
4. Legal-Issues
5. International Considerations

I strongly urge all levels of government to adopt this principle to ensure protection of the populations who live near existing radio frequency antennas and to place new antennas at a sufficient distance to minimize human and animal exposure.

This expert testimony is respectfully submitted by Dr. Magda Havas, October 10, 2005.

Annexe 5

Power Density: Radio frequency Non-Ionizing Radiation

'… the possibility of harm from exposures [to low levels of radio frequency radiation] insufficient to cause important heating of tissues cannot yet be ruled out with confidence. Furthermore, the anxieties that some people feel when this uncertainty is ignored can in themselves affect their well-being.'

Sir William Stewart (Chairman)
Mobile Phones and Health:
A report from the Independent Expert Group on Mobile Phones,
(*The Stewart Report*, 2000)

Power Density: Definition

Above 30 MHz, the usual unit of measurement is power density, though electric and magnetic fields can also be measured. It is usually expressed in milli- or microwatts per square centimetre (mW/cm2 or µW/cm2), and is defined as the amount of power per unit area in a radiated microwave field or other type of electromagnetic field.

Introduction

Research from abroad, partially replicated (and in some instances expanded on) by scientists in English speaking countries, indicates many potential benefits in health, wellbeing and work productivity can be obtained from developing a more comprehensive understanding of potential EMF bio-effects. They also indicate ways in which present communications systems, and the electromagnetic nature of the microenvironments individuals occupy, can be improved to benefit all. It is suggested that the potential cost benefits of adopting improved EMF-hygiene protocols and developing new generations of technology that can actually improve biological functioning and human performance is immense, makes tremendous commercial sense and present enormous commercial opportunities.

As can be seen in the following table, both beneficial and detrimental biological effects are indicated at exposure levels far lower than those required for 'thermal effects', the traditional marker used to set many guidelines on presently 'acceptable' power density levels.

The Precautionary Principle/Approach?

'… [the] *actions taken under the precautionary principle should be commensurate with anticipated risks of health detriment*.'

Section 6.14
The Stewart Report, 2000

The need for additional impartial scientific research appears warranted to address such concerns for everyone's benefit and that of the planet...

Power Density –
International Regulations and Possible Biological Effects

Power Density	Reported Biological Effects / Comments	References
0.000000000000001 μW/cm^2	**Cosmic background** at 1800 MHz approx. average	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.0000000001μW/cm^2	**Natural background level for all RF frequencies**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.0000000001 μW/cm^2	**Threshold of human sensitivity**	N.N. Kositsky, A.I. Nizhelska and G.V. Ponezha (2001), Influence of high-frequency electromagnetic radiation at non-thermal intensities on the human body (a review of work by Russian and Ukrainian researchers) *Translation by Patricia Ormsby, No Place To Hide,* 3(1) Supplement. www.emfacts.com/ussr_review.pdf
0.0000000001 – 0.00000001 μW/cm^2	**Normalising effect on cell growth** of isolated cells damaged by ionising radiation exposed for 7 minutes	L.S. Bundyuk, A.P. Kuz'menko, N.N Ryabchenko and G.S. Litvinov (1994), Corrective action of millimeter waves on systems of various levels of hierarchy. *Physics of the Alive,* 2(1):12-25, cited by Kositsky et al 2001.
0.0000000002 μW/cm^2	**Mobile phone handsets can work down to about this level**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.000000001 μW/cm^2	Altered EEG in humans – a relaxation frequency of protein-bound water thought to occur between 100 - 1,000 MHz. Absorption and quantum effects may be the mechanistic basis for EEG changes noted in most subjects from 0.000000001 μW/cm^2 CW RF energy of 130-960 MHz.	W. Bise (1978), Low power radio-frequency and microwave effects on human electroencephalogram and behavior. *Physiological Chemistry and Physics,* 10(5):387-398. www.ncbi.nlm.nih.gov (abstract)
0.0000000027 μW/cm^2	Growth stimulation in Vicius fabus	Brauer (1950), Experimental studies on the effect of meter waves of various field intensities on the growth of plants by division. *Chromosoma* 3:483-509.
0.00000001 μW/cm^2	**Effects on immune system of mice** exposed for 5 minutes per day for 5 days to 54-76 GHz at this level	L.S. Bundyuk, A.P. Kuz'menko, N.N Ryabchenko and G.S. Litvinov (1994), Corrective action of millimeter waves on systems of various levels of hierarchy. *Physics of the Alive,* 2(1):12-25, cited by Kositsky et al 2001.
0.00000002 μW/cm^2	Stimulation of ovulation in chickens	P.A. Kondra, W.K. Smith, G.C. Hodgson, D.B. Bragg, J. Gavora, M.A.K. Hamid and R.J. Boulanger (1970), Growth and reproduction of chickens subjected to microwave radiation. *Canadian Journal of Animal Science* 50:639-644, cited by A. Firstenberg 2001.
<0.000001 μW/cm^2	**Altered EEG in humans** – temporary changes in brain waves and behaviour.	W. Bise (1978), Low power radio-frequency and microwave effects on human electroencephalogram and behavior. *Physiological Chemistry and Physics,* 10(5):387-398. www.ncbi.nlm.nih.gov (abstract)
0.000001 μW/cm^2	**Burgerforum BRD proposal, sleeping areas (1999)**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.000005 μW/cm^2	Effect on cell growth rate in yeast *S. cerevisae*	W. Grundler and F. Kaiser (1992), Experimental evidence for coherent excitations correlated with cell growth. *Nanobiology* 1:163-176
0.00001 μW/cm^2	**Conditioned 'avoidance' reflex in rats**	N.N. Kositsky, A.I. Nizhelska and G.V. Ponezha (2001), Influence of high-frequency electromagnetic radiation at non-thermal intensities on the human body (a review of work by Russian and Ukrainian researchers) *Translation by Patricia Ormsby, No Place To Hide,* 3(1) Supplement. www.emfacts.com/ussr_review.pdf
0.000027 μW/cm^2	**Premature aging of pine needles**	Selga, T. & Selga, M. (1996), Response of *Pinus sylvestris L*. needles to electromagnetic fields. Cytological and ultrastructural aspects. *The Science of the Total Environment* 180:65-73, Elsevier Science BV.
0.0001 μW/cm^2	**Burgerforum BRD proposal, waking areas (1999)**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.0001 μW/cm^2	**Salzburg GSM/3G inside houses (2002)**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp

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0.001 μW/cm^2	100 Yards from a Cellular Phone	A. Firstenberg (2001), Radio Wave Packet, www.goodhealthinfo.net/radiation/radio_wave_packet.pdf.
0.001 μW/cm^2	**Exposure Limit in New South Wales, Australia as at 2001**	A. Firstenberg (2001)
0.001 μW/cm^2	**Salzburg GSM/3G outside houses (2002)**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.002 μW/cm^2	**Sleep disorders, abnormal blood pressure, nervousness, weakness, fatigue, limb pain, joint pain, digestive problems, fewer schoolchildren promoted** – controlled study near a shortwave transmitter	Altpeter *et al*. (1995, 1997), Study on health effects of the shortwave transmitter station of Schwarzenburg, Berne, Switzerland, Study No. 55, Swiss Federal Office of Energy), cited by A. Firstenberg 2001.
0.0027 μW/cm^2	Growth inhibition in Vicius fabus	I. Brauer (1950), Experimental studies on the effect of meter waves of various field intensities on the growth of plants by division. *Chromosoma* 3:483-509, cited by A. Firstenberg 2001.
0.0027 to 0.065 μW/cm^2	**Smaller tree growth rings**	Balodis, V., *et al* (1996), Does the Skrunda Radio Location Station diminish the radial growth of pine trees? *The Science of the Total Environment* 180:57-64.
0.0048 μW/cm^2	Median level, 15 US cities 1977 (mainly VHF & TV)	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.007 μW/cm^2	50 Feet from a Cordless Phone	A. Firstenberg (2001).
0.01 μW/cm^2	**Human sensation**	Kolbun and Sit'ko (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, cited by A. Firstenberg 2001.
0.01 μW/cm^2	**EU-Parl, GD Wissenschaft, STOA GSM (2001), Public Exposure Guidelines at 1800 MHz**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.016 μW/cm^2	1 Mile from a Cellular Tower	A. Firstenberg (2001)
0.04 – 0.2 μW/cm^2	SAR-value of 80-400 μW/kg, 0.002 V/m at 947.5 MHz	O. Johansson (1995), 'Elöverkänslighet samt överkänslighet mot mobiltelefoner: Resultat från en dubbel-blind provokationsstudie av metodstudiekaraktär' (=Electrohypersensitivity and sensitivity to mobile telephones: Results from a double-blind provocation study of pilot character', in Swedish), Enheten för Experimentell Dermatologi, Karolinska Institutet, Stockholm, Rapport nr. 2, 1995, ISSN 1400-6111
0.06 μW/cm^2	**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 & Shandala (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. Czerski et al., eds., cited by A. Firstenberg 2001.
0.05 μW/cm^2	10 Feet from a Wireless Computer	A. Firstenberg (2001).
0.06 μW/cm^2	Slowing of the heart, change in EEG in rabbits	Serkyuk, reported in McRee 1980, cited by A. Firstenberg 2001.
0.1 μW/cm^2	**Italy (single frequency), Public Exposure Guidelines at 1800 MHz**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.1 μW/cm^2	**Salzburg 1998 (sum GSM), Public Exposure Guidelines at 1800 MHz**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
0.1 μW/cm^2 (0.001 W/Kg SAR)	**EEG brain waves altered under exposure to cell phone signal**	L. Von Klitzing (1995), 'Low-Frequency pulsed electromagnetic fields influence EEG of man.' Physica Medica, Vol. 11, No. 2, pps 77-80, April-June 1995, cited by C. Sage 2004.

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0.1 μW/cm^2	Increased in melatonin in cows on 1st night of re-exposure after 3-30 MHz transmitter inoperational for 3 days – difference in salivary melatonin concentration statistically significant, indicating a 2-7-fold increase of melatonin concentration.	K.D.C. stark , T. Krebs, E. Altpeter, B. Manz, C. Griot and T. Abelin (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(4):171-176.
0.1 to 1.8 μW/cm^2	Decreased life span, impaired reproduction, structural and developmental abnormalities in duckweed plants	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.
0.13 μW/cm^2	**Decreased cell growth** (human epithelial amnion cells)	Kwee & Raskmark (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.
0.16 μW/cm^2	**Attention, memory and motor function of school children significantly affected in comparison to control groups.** Reaction times slower and neuromuscular apparatus endurance also reduced.	A.A. Kolodynski and V.V. Kolodynska (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 (1):87-93.
0.168 μW/cm^2	**Progressive decrease in number of newborns and irreversible infertility in mice** after 5 generations exposure to radiation from 'antenna park'.	I.N. Magras and T.D. Zenos (1997), RF Radiation-Induced Changes in the Prenatal Development of Mice, Bioelectromagnetics, 18(6), pp. 455-461.
0.2 – 8 μW/cm^2	**Two-fold increase in childhood leukaemia from AM-FM exposure from TV towers compared to areas with levels of 0.02 μW/cm^2**	B. Hocking, I.R. Gordon and H.L. Grain (1996), Cancer incidence and mortality and proximity to TV towers. *Medical Journal of Australia* 165(11-12):599-600, cited by Sage 2004.
0.3 μW/cm^2	**Impaired motor function, reaction time, memory and attention of schoolchildren, and altered sex ratio of children (fewer boys)**	A.A. Kolodynski and V.V. Kolodynska (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.
0.6 μW/cm^2	**Change in calcium ion efflux from brain tissue**	S. K. Dutta 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, cited by A. Firstenberg 2001.
0.6 μW/cm^2	**Cardiac arrhythmias and sometimes cardiac arrest (frogs)**	Frey, 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.
0 – 4 μW/cm^2	**Altered white blood cell activity in schoolchildren**	H. Chiang et al., 1989. Health effects of environmental electromagnetic fields. *Journal of Bioelectricity* 8(1):127-131, cited by A. Firstenberg 2001
1.0 μW/cm^2	**Headache, dizziness, irritability, fatigue, weakness, insomnia, chest pain, difficulty breathing, indigestion (humans—occupational exposure)**	V. B. Simonenko et al., 1998. Influence of electromagnetic radiation in the radiofrequency range on the health condition of an organized collective. *Voenno-meditsinskiy zhurnal* CCCXIX(5):64-68, cited by A. Firstenberg (2001)
1.0 μW/cm^2	Stimulation of white cells in guinea pigs	M.G. Shandala and G.I. Vinogradov, 1978. Immunological effects of microwave action. *Gigiyena i Sanitariya,* no. 10:34-38, JPRS 72956, pp. 16-21, cited by A. Firstenberg (2001)
1 μW/cm^2	**Change in immunological functions** in NMRI mice after exposure to whole body microwave sinusoidal irradiation of 8.15-18 GHz (1 Hz within).	E.E. Fesenko, V.R. Makar, E.G. Novoselova and V.B. Sadovnikov (1999), Microwaves and cellular immunity. I. Effect of whole body microwave irradiation on tumor necrosis factor production in mouse cells. Bioelectrochemistry and Bioenergetics, 49(1):29-35.

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1 μW/cm^2	In vivo irradiation at 8.15-18 GHz (1 Hz within) increased cytotoxic activity of natural killer cells in rat spleen. For mice exposed 24-72 hours, activity of natural killer cells increased 130-150%. This level persisting within 24 hours after end of treatment. In vivo irradiation for 3.5 and 5 hours, and short exposure of splenic cells in vitro did not affect activities of natural killer cells.	E.E. Fesenko, E.G. Novoselova, N.V. Semiletova, T.A. Agafonova and V.B. Sadovnikov (1999), [Stimulation of murine natural killer cells by weak electromagnetic waves in the centimeter range]. Biofizika 44(4), pp.737-741, (Article in Russian), cited by A. Marino, Recent studies (1995-2000) on the biological effects of radiofrequency and cell phone radiation, www.niehs.nih.gov/emfrapid/extrmurabs/marino.html
1 μW/cm^2	**Immune system response affected by a single 5-hour whole-body exposure to 8.15-18 GHz microwave radiation (with 1 Hz impulse frequency)** that stimulated the immune potential of macrophages and T cells. Antioxidant treatment (through diet) was found to further enhance this effect.	E.G. Novoselova, E.E. Fesenko, V.R. Makar and V.B. Sadovnikov (1999), Microwaves and cellular immunity. II. Immunostimulating effects of microwaves and naturally occurring antioxidant nutrients. Bioelectrochemistry and Bioenergetics, 49(1):37-41.
1 μW/cm^2	**Standards in the former USSR for permissible exposure levels to 30-300 MHz for 8-hour workday.**	Yu.D. Dumanskiy and V.Ye. Prokhvatilo (1979), Electromagnetic field of industrial frequency as a factor in the environment and its hygienic regulation. *Gigiena i sanitariya* 5:72-74, cited by Kositsky et al 2001.
1 μW/cm^2	**Wien (sum GSM)**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
1 μW/cm^2	Typical reading 100 metres from base station (0.2 to 6 V/m)	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
1.053 μW/cm^2	**Irreversible infertility in mice after 3 generations** exposure to radiation.	I.N. Magras and T.D. Zenos (1997), RF Radiation-Induced Changes in the Prenatal Development of Mice, Bioelectromagnetics, 18(6), pp. 455-461.
1.3 – 5.7 μW/cm^2	**Exposure to AM RF caused two-fold increase in leukaemia in adults**	H. Dolk, G. Shaddick, P. Walls, C. Grundy, B. Thakrar, I. Kleinschmidt and P. Elliott (1997), cited by Sage 2004. Cancer incidence near radio and television transmitters in Great Britain. Am J Epidemiology 145(1) P 1-9 Jan 1997.
2–10 μW/cm^2 Exposure Limit in Bulgaria, Hungary, Russia and Switzerland as at 2001, cited by A. Firstenberg 2001.		
2.0 μW/cm^2 (lower threshold not known)	**'Microwave hearing'— buzzing, chirping, clicking, hissing, or high-pitched tones.**	A.H. Frey (1963), Human response to very-low-frequency electromagnetic energy. *Nav. Res. Rev.* 1968:1-4. A.H. Frey (1971), Biological function as influenced by low power modulated RF energy. *IEEE Transactions on Microwave Theory and Techniques,* MTT-19(2):153-164. A.H. Frey and R. Messenger (1973), Human perception of illumination with pulsed ultrahigh-frequency electromagnetic energy. *Science* 181:356-358, cited by A. Firstenberg 2001.
2.0 μW/cm^2	'Microwave hearing'— buzzing, chirping, clicking, hissing, or high-pitched tones.	D.R. Justeson (1979), Behavioral and psychological effects of microwave radiation. *Bulletin of the New York Academy of Medicine* 55(11):1058-1078, cited by A. Firstenberg 2001.
2.0 μW/cm^2	'Microwave hearing'— buzzing, chirping, clicking, hissing, or high-pitched tones.	R.G. Olsen (1980), Evidence for microwave-induced acoustic resonances in biological material. *Bioelectromagnetics* 1:219, cited by A. Firstenberg 2001.
2.0 μW/cm^2	'Microwave hearing'— buzzing, chirping, clicking, hissing, or high-pitched tones.	C.W. Wieske (1963), 'Human Sensitivity to Electric Fields.' Proceedings of the First National Biomedical Sciences Instrumentation Symposium. (Vol. 1). Ed. Dr. Fred Alt. New York: Plenum Press, 1963, cited by A. Firstenberg 2001.
2.0 μW/cm^2	'Microwave hearing'— buzzing, chirping, clicking, hissing, or high-pitched tones.	J.C. Lin (1978), *Microwave Auditory Effects and Applications.* Springfield, IL: Charles C. Thomas, Publisher, Springfield, IL 1978, 221 pp, cited by A. Firstenberg 2001.
2.4 μW/cm^2	**Belgium (Wallonia)**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
2.4 μW/cm^2	**Interference caused to medical devices** at least up to 1000 MHz (from digital mobile phones).	K.J. Clifford, K.H. Joyner, D.B. Stroud, M. Wood, B. Ward and C.H. Fernandez (1996), Mobile telephones interfere with medical electrical equipment. Australas Phys Eng Sci Med 1994 Mar. 17(1). P 23-7, cited by C. Sage 2004

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2.5 µW/cm^2	**Breakdown of blood-brain barrier** (digital cellular phone used to provide the radiation)	Salford *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., cited by A. Firstenberg 2001.
2 – 4 µW/cm^2	**Low power microwaves directly effect the operation of cellular ACh-related ion-channels that have vital roles in behavioural and physiological functions.**	G. D'Inzeo, P. Bernardi, F. Eusebi, F. Grassi, C. Tamburello and B.M. Zani (1988), Microwave effects on acetylcholine-induced channels in cultured chick myotubes. *Bioelectromagnetics* 9(4):363-372.
4 µW/cm^2	**Standards in the former USSR for permissible exposure levels to 3-30 MHz for 8-hour workday.**	Yu.D. Dumanskiy and V.Ye. Prokhvatilo (1979), Electromagnetic field of industrial frequency as a factor in the environment and its hygienic regulation. *Gigiena I sanitariya* 5:72-74, cited by Kositsky et al 2001.
4 – 10 µW/cm^2	**Lower memory function/visual reaction time in children slowed in tests**	H. Chiang, G.D. Yao, Q.S. Fang, K.Q. Wang, D.Z. Lu and Y.K. Zhou (1989), Health effects of environmental electromagnetic fields. Journal of Bioelectricity, 8: 127-131, cited by Sage 2004.
5 µW/cm^2	**Standards in the former USSR for permissible exposure levels to 0.3-300 GHz for 8-hour workday.**	Yu.D. Dumanskiy and V.Ye. Prokhvatilo (1979), Electromagnetic field of industrial frequency as a factor in the environment and its hygienic regulation. *Gigiena I sanitariya* 5:72-74, cited by Kositsky et al 2001.
5.0 µW/cm^2	Study investigated immune systems of women exposed to 500 KHz-3 GHz fields from radio/television transmitters in their residential area for ≥2 years. Exposure levels of 4.3 ±1.4 V/m (mean +/- S.D.) measured on the balconies of the women's homes. Control group exposed to <1.8 V/m fields. Higher field exposure found to reduce cytotoxic activity in the women's peripheral blood without a dose-response effect.	P. Boscol, M.B. Di Sciascio, S. D'Ostilio, A. Del Signore, M. Reale, P. Conti, P. Bavazzano, R. Paganelli & M. Di Gioacchino (2001), Effects of electromagnetic fields produced by radiotelevision broadcasting stations on the immune system of women. *Sci Total Environ* 273(1-3):1-10.
5.0 µW/cm^2	**Leukaemia, skin melanoma and bladder cancer near TV and FM transmitter**	H. Dolk, G. Shaddick, P. Walls, C. Grundy, B. Thakrar, I. Kleinschmidt and P. Elliott (1997), cited by Sage 2004. Cancer incidence near radio and television transmitters in Great Britain. Am J Epidemiology 145(1) P 1-9 Jan 1997.
5.0 µW/cm^2	**Biochemical and histological changes in liver, heart, kidney, and brain tissue**	V.S. Belokrinitskiy (1982), 'Hygienic evaluation of biological effects of nonionizing microwaves', *Gigiyena i Sanitariya* 6:32-34, JPRS 81865, pp. 1-5, cited by A. Firstenberg 2001.
5 – 10 µW/cm^2	**Nervous system activity impaired**	Dumanski and Shandala (1974), The Biological Action and Hygenic Significance of Elecromagnetic Fields of Superhigh and Ultrahigh frequencies in Densely Populated Areas,' from Biological Effects and Health Hazards of Microwave Radiation. Proceedings of an International Symposium, Warsaw 15-18 October, 1973, Polish Medical Publishers, Warsaw, 1974, cited by Sage 2004.
7–10 µW/cm^2	**Exposure Limit in People's Republic of China as at 2001**,	Cited by A. Firstenberg 2001.
8 µW/cm^2	**Association between increased incidences of childhood leukaemia and mortality through RF fields from TV transmitters in comparison to areas with lower power densities.** Overall rate ratio of incidence was 1.58 (95% CI, 1.07-2.34). For mortality it was 2.32 (95% CI, 1.35-4.01). For childhood lymphatic leukaemia the rate ratio for incidence was 1.55 (95% CI, 1.00-2.41) and 2.74 (95% CI, 1.42-5.27) for mortality.	B. Hocking, I.R. Gordon, H.L. Grain and G.E. Hatfield (1996), Cancer incidence and mortality and proximity to TV towers. Med J Aust 165(11-12), pp. 601-605, 1996. (Published erratum appears in Med J Aust 166(2):80, 1997), cited by A. Marino, Recent studies (1995-2000) on the biological effects of radiofrequency and cell phone radiation, www.niehs.nih.gov/emfrapid/extrmurabs/marino.html

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9.5 μW/cm^2	**Switzerland, Lichtenstein, Luxembourg**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
10 μW/cm^2	**Russian Federation, People's Republic of China, Public Exposure Guidelines at 1800 MHz**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
10 μW/cm^2	**Italy (sum of frequencies)**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
10 μW/cm^2	**Maximum permitted exposure levels for base stations inside and outside of living, public and industrial areas for 300-2400 MHz frequencies** (Russian Federation, since 1 June 2003)	Hygienic requirements for siting and exploitation of land mobile telecommunication systems, SanPiN 2.1.8/2.2.4.1190-03 (2003), Ministry of Health of Russian Federation / Russian Ministry of Health Protection, SanPiN (Sanitary and Epidemiological Norms). (Standard for siting and using 27-2400 MHz land mobile phone systems in the Russian Federation).
10 μW/cm^2	**Impaired / reduced short-term memory function and significant differences in visual reaction time** (1170 test subjects).	H. Chiang, G.D. Yao, Q.S. Fang, K.Q. Wang, D.Z. Lu and Y.K. Zhou (1989), Health effects of environmental electromagnetic fields. *J. Bioelectricity* 8(1):127-131.
10.0 μW/cm^2	**Decreased size of litter, increased number of stillborns in mice**	Il'Chevich (reported in McRee 1980), cited by A. Firstenberg 2001.
≤10 μW/cm^2 (max. mean exposure)	**Sperm counts of Danish military personnel operating mobile ground-to-air missile units, which used several RFR emitting radar systems, were significantly lower than controls.**	N.H. Hjollund, J.P. Bonde, J. Skotte (1997), Semen analysis of personnel operating military radar equipment. *Reprod Toxicol* 11(6):897, cited by www.energyfields.org/science/CWTI.RFR_studies_2.02.doc
10.0 μW/cm^2	Redistribution of metals in the blood, bones, brain, heart, liver, lungs, kidney, muscles, spleen and skin	O.I. Shutenko, I.P. Kozyarin and I.I. Shvayko (1981), Effects of superhigh frequency electromagnetic fields on animals of different ages. *Gigiyena i Sanitariya, no.* 10:35-38, JPRS 84221, pp. 85-90, cited by A. Firstenberg 2001.
10 μW/cm^2	**Damaged mitochondria, nucleus of cells in hippocampus of brain**	V.S. Belokrinitskiy (1982), Destructive and reparative processes in hippocampus with long-term exposure to nonionizing microwave radiation. *Bulletin of Experimental Biology and Medicine* 93(3):89-92, cited by A. Firstenberg 2001.
10 μW/cm^2	Altered brain permeability	W.R. Adey (1982).
10 – 25 μW/cm^2	Changes registered in hippocampus of the brain	Belokrinitskiy, 1982, cited by Sage 2004 'Destructive and reparative processes in hippocampus with long-term exposure to nonionizing radiation.' In U.S.S.R. Report, Effects of Nonionizing Microwave Radiation, No. 7, JPRS 81865, pp. 15-20.
10 – 100 μW/cm^2	RFR at low intensities (0.0027- 0.027 W/kg) induced behavioural and endocrine changes in rats. Decreases in blood concentrations of insulin and testosterone reported, though CW microwaves had no influence on insulin secretion. Inhibition of behaviour by microwaves may depend on strength, exposure time and inhibitory effects on nervous system. Activation correlated with decreases in serum concentrations of insulin and testosterone.	M.A. Navakatikian, L.A. Tomashevskaya (1994), Phasic behavioral and endocrine effects of microwaves of nonthermal intensity. In 'Biological Effects of Electric and Magnetic Fields, Volume 1,' D.O. Carpenter (ed) Academic Press, San Diego, CA, pp.333-342, cited by www.energyfields.org/science/CWTI.RFR_studies_2.02.doc

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20 μW/cm^2	**Changes in brain wave patterns caused by microwave or radio frequency radiation**	C.H. Dodge and Z.R. Glaser, 1977. 'Trends in non-ionizing electromagnetic radiation bio-effects research and related occupational health aspects', *Journal of Microwave Power,* 12, 4 (1977)), cited by P. Bentham (1991), VDU Terminal Sickness: Computer health risks and how to protect yourself, Green Print, London, ISBN 1 85425 043 4.
20 μW/cm^2	Pulsed RF radiation (900 MHz with 217 Hz pulse) slightly elevated cortisol serum level (cortisol is a hormone involved in stress reactions). The increase was transient, suggesting adaptation to the stimulus by the subject. No significant effects found for growth hormone, luteinizing hormone or melatonin under field exposure compared to control condition. The EEG sleep-data revealed no significant variations on exposure, although there was a trend for suppressed REM.	K. Mann, P. Wagner, G. Brunn, F.Hassan, C. Hiemke and J. Roschke (1998), Effects of pulsed high-frequency electromagnetic fields on the neuroendocrine system. *Neuroendocrinology* 67(2):139-144.
25 μW/cm^2 at 300 MHz-300 GHz.	**Workers' exposure standard in Russia for 8-hour day (occupational standard introduced in 1986) The standard is based on the total amount of energy absorbed and permits exposures for shorter time periods, e.g. 100 μW/cm² for 2 hours**, cited by C.W. Smith & S. Best (1989).	
27 μW/cm^2	**Standards in the former USSR for permissible exposure levels to 0.3-3 MHz for 8-hour Workday**.	Yu.D. Dumanskiy and V.Ye. Prokhvatilo (1979), Electromagnetic field of industrial frequency as a factor in the environment and its hygienic regulation. *Gigiena i sanitariya* 5:72-74, cited by Kositsky et al 2001.
30 μW/cm^2 (0.015 W/Kg SAR)	Elevation of PFC count (antibody producing cells) in immune system	B. Veyret, C. Bouthet, P. Deschaux, R. de Seze, M. Geffard, J. Joussot-Dubien, M. le Diraison, J.-M. Moreau and A. Caristan (1991), Antibody responses of mice exposed to low-power microwaves under combined, pulse and amplitude modulation,' Bioelectromagnetics 12: P 47-56), cited by Sage 2004.
30 μW/cm^2	Increased brain-amine levels	W.R. Adey (1982).
32.5 μW/cm^2	102nd Floor, Empire State Building in New York	R. Tell & N. H. Hankin (1978), 'Measurements of Radio Frequency Field Intensity in Buildings with Close Proximity to Broadcast Systems', ORP/EAD 78-3, U.S. Environmental Protection Agency, Las Vegas.
50 μW/cm^2	**Exposure Limit in Auckland, New Zealand as at 2001**	A. Firstenberg (2001).
50 μW/cm^2	**18% reduction in REM sleep, which is important to learning and memory functions**	Mann *et al*., 1996, cited by Sage 2004. Effects of pulsed high-frequency electromagnetic fields on human sleep. Neuropsychobiology 1996;33:41-7.
50 μW/cm^2	**Decreased sperm counts**	W.R. Adey (1982).
50 μW/cm^2	2.375 GHz exposure for 30 days resulted in decreased T-cell responses with suppressed phagocytosis noted in rats and guinea pigs.	M.G. Shandala, M.I. Rudnex, G.K. Vinogradov, N.G. Belonozhko and N.M. Gonchar (1977), Immunological and haematological effects of microwave radiation at low power densities. In: Proceedings of the International Union Radio Science Symposium on Biological Effects of Electromagnetic Waves, Airlie, V.A., p. 84, cited by Adey, 1982.
50 μW/cm^2	No differences noted in the awake EEG of healthy subjects exposed nearly 3.5 minutes to the 900 MHz radiation pulsed at 217 Hz with a pulse width of 580 microseconds when compared to effects of inactive GSM system.	J. Roschke and K. Mann (1997), No short-term effects of digital mobile radio telephone on the awake human electroencephalogram. Bioelectromagnetics 18(2), pp.172-176.
60 μW/cm^2	**Disturbance of female cycles of test animals, reduced fertility, dystrophic changes in reproductive organs.** Reduced weight and number of offspring; postnatal deaths of rat pups increased by factor of 2.5.	H.G. Nikitina and L.G. Andrienko (1989), Condition of reproductive functions in experimental animals under the influence of electromagnetic radiation of mm waves. *Fundamental and Applied aspects of Use of mm Electromagnetic Radation in Medicine, Proceedings of the 1st All-Union Symposium with International Participation* (10-13 May 1989, Kiev). Kiev: VNK 'Otklik,' pp. 288-289, 1989, cited by Kositsky et al 2001.

Power Density	Reported Biological Effects / Comments	References
60 μW/cm^2	**Brain wave activation observed in human subjects exposed to 902.4 MHz mobile-phone radiation.** Significant correlation on EEG recordings noted, particularly when the subjects eyes were closed. This was suggested to be a manifestation of cortex activation under mobile-phone EMF exposure.	N.N. Lebedeva, A.V. Sulimov, O.P. Sulimova, T.I. Kotrovskaya and T. Gailus (2000), Cellular phone electromagnetic field effects on bioelectric activity of human brain. *Crit Rev Biomed Eng* 28(1-2):323-337. Cited by www.energyfields.org/science/CWTI.RFR_studies_2.02.doc
65.9 μW/cm^2	50th Floor, Sears Building in Chicago	R. A. Tell and N. N. Hankin (1978), "Measurements of radiofrequency field intensities in buildings with close proximity to broadcast stations," Environmental Protection Agency Technical Note, ORP/EAD 78-3, Aug. 1978 (NTIS Order No. PB 290 944/AS), cited by R.O. Becker & G. Selden (1985), The Body Electric, Quill, ISBN 0-688-06971-1.
67.4 μW/cm^2	47th Floor, 1100 Milam Building in Houston	R. A. Tell and N. N. Hankin (1978), "Measurements of radiofrequency field intensities in buildings with close proximity to broadcast stations," Environmental Protection Agency Technical Note, ORP/EAD 78-3, Aug. 1978 (NTIS Order No. PB 290 944/AS), cited by R.O. Becker & G. Selden (1985).
1 - 97 μW/cm^2	Location specific values found inside tall U.S. buildings that housed or were near broadcast antennas.	R. A. Tell and N. N. Hankin (1978), "Measurements of radiofrequency field intensities in buildings with close proximity to broadcast stations," Environmental Protection Agency Technical Note, ORP/EAD 78-3, Aug. 1978 (NTIS Order No. PB 290 944/AS).
98.6 μW/cm^2	38th Floor, One Biscayne Tower in Miami	R. A. Tell and N. N. Hankin (1978), "Measurements of radiofrequency field intensities in buildings with close proximity to broadcast stations," Environmental Protection Agency Technical Note, ORP/EAD 78-3, Aug. 1978 (NTIS Order No. PB 290 944/AS), cited by R.O. Becker & G. Selden (1985).
100 μW/cm² at 300 MHz-300 GHz for max. 2 hours.	**Workers' exposure standard in Russia for 8-hour day (occupational standard introduced in 1986) Standard based on total amount of energy absorbed**, cited by C.W. Smith & S. Best 1989.	
100 μW/cm^2	**Maximum permitted exposure levels for MPEL for mobile stations (including cellular phones) for 300-2400 MHz frequencies** (Russian Federation, since 1 June 2003)	Hygienic requirements for siting and exploitation of land mobile telecommunication systems, SanPiN 2.1.8/2.2.4.1190-03 (2003), Ministry of Health of Russian Federation / Russian Ministry of Health Protection, SanPiN (Sanitary and Epidemiological Norms). (Standard for siting and using 27-2400 MHz land mobile phone systems in the Russian Federation).
<100 μW/cm^2	54-900 MHz exposure of 95% U.S. urban population in 1979. In urban areas median exposure was 0.005 μW/cm^2.	EPA (Environmental Protection Agency) (1978), Population Exposure to VHF and UHF Broadcast Radiation in the United States, R.A. Tell and E.D. Mantiply, EPA Technical Report ORP/EAD 78-5. Cited in "An Assessment of Potential Health Effects from Exposure to PAVE PAWS Low-Level Phased-Array Radiofrequency Energy" , Board on Radiation Effects Research (2005), http://books.nap.edu/openbook.php?record_id=11205&page=48
100 μW/cm^2	**Changes registered in immune system function of male mice**	Elekes et al., 1996. Effect on the immune system of mice exposed chronically to 50 Hz amplitude-modulated 2.45 GHz microwaves. Bioelectromagnetics Vol 17, Issue 3, pp.246-8, cited at www.cellphonesar.com/research/rf_radiation
100 μW/cm^2	**26% drop in insulin registered**	Navakatikian & Tomashevskaya, 1994. 'Phasic Behavioral and Endocrine Effects of Microwaves of Nonthermal Intensity,' by Carpenter DO and Ayrapetyan S, editors. Biological Effects of Electric and Magnetic Fields. Volume 1, published by Academic Press, cited at www.cellphonesar.com/research/rf_radiation
111.5 μW/cm^2	**Belgium (ex Wallonia) Public Exposure Guidelines at 1800 MHz**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp

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120 µW/cm^2	**Pathological change noted in the blood brain barrier at 915 MHz**	Salford, L.G., Brun, A., Perrson, B.R.R., and Eberhardt, J., 1993. 'Experimental studies of brain tumor development during exposure to continuous and pulsed 915 MHz radio frequency radiation,' in Bioelectrochemistry and Bioenergetics, Vol. 30: pp. 313-318.
180.3 µW/cm^2	Roof, Home Tower in San Diego	R. Tell & N. H. Hankin (1978), cited by R.O. Becker & G. Selden (1985).
200 µW/cm^2 Public exposure (average)	**ICNIRP public guidance levels at 400 MHz (TETRA) and 28 V/m. ICNIRP (& UK) Standard Guidance is based on power levels averaged over 6 minutes. Reference level category 100 – 400 MHz**, cited by A. Philips (2002)	
200 µW/cm^2	**Exposure Limit in Australia as at 2001**, cited by A. Firstenberg 2001.	
200 – 1000 µW/cm^2	**Exposure Limit in Canada, Germany, Japan, New Zealand and US as at 2001**, cited by A. Firstenberg 2001.	
250-500 µW/cm^2	**Decreased reproductive capacity and litter size**, also premature cessation of reproductive function in mice exposed to microwaves for 4 hours a day for 48 weeks – details on carrier frequencies not given.	Z.V. Gordon, A.V. Rosein and M.S. Byskov (1974), 'Main directions and results of research conducted in USSR on the biologic effects of microwaves,' Biologic Effects and Health Hazards of Microwave Radiation, P. Czerski, ed., Polish Medical Publications, Warsaw, p. 22-35, cited by W.R. Adey, 1982.
≤230 µW/cm^2	Location specific values measured outside tall buildings in close proximity to broadcast antennas.	R. A. Tell and N. N. Hankin (1978), "Measurements of radiofrequency field intensities in buildings with close proximity to broadcast stations," Environmental Protection Agency Technical Note, ORP/EAD 78-3, Aug. 1978 (NTIS Order No. PB 290 944/AS).
0.2-360 µW/cm^2	**Mortality rate of exposed chickens almost twice that of control colony.**	C. Romero-Sierra and J.A. Tanner (1970), Microwave Radiation and Egg Production in Chickens. Proceedings of IMPI 5th Annual Microwave Symposium, Schevenigen, Holland. October 1970.
10-10,000 µW/cm^2	Deterioration noted in radiation sensitive Mimosa plant.	C. Romero-Sierra, J.A. Tanner, J. Bigu del Blanco (1973), Interaction of Electromagnetic fields And Living Systems With Special Reference To Birds, Control Systems Laboratory, Division of Mechanical Engineering / Division de Génie Mécanique, Canada, Report LTR-CS-113, presented to International Symposium on Biological Effects and Health Hazards of MW Radiation, World Health Organization, Warsaw, October 1973, 37 pp.
400 µW/cm^2	**Standards in the former USSR for permissible exposure levels to 30-300 kHz for 8-hour workday.**	Yu.D. Dumanskiy and V.Ye. Prokhvatilo (1979), Electromagnetic field of industrial frequency as a factor in the environment and its hygienic regulation. *Gigiena i sanitariya* 5:72-74, cited by Kositsky et al 2001.
>500 µW/cm^2	**Autoimmune disease evoked**, along with production of anti-liver and anti-brain antibodies.	M.G. Shandala, M.I. Rudnex, G.K. Vinogradov, N.G. Belonozhko and N.M. Gonchar (1977), Immunological and haematological effects of microwave radiation at low power densities. In: Proceedings of the International Union Radio Science Symposium on Biological Effects of Electromagnetic Waves, Airlie, V.A., p. 84, cited by Adey, 1982.
500 µW/cm^2	**High Blood Pressure due to imbalances of Potassium and Sodium levels in the body**, also significant shifts in carbon dioxide – rats exposed to 2,450 MHz for 7 hours a day for 3 months.	R.H. Lovely, A.W. Guy, R.B. Johnson, and M. Mathews (1978), Alteration of behavioural and biochemical parameters during and consequent to 500 µW/cm^2 chronic 2450 MHz microwave exposure, Proceedings of the International Symposium on Electromagnetic Waves and Biology, Ottawa, p. 34, cited by W.R. Adey (1982).
500 µW/cm^2	Peak level at residential locations near the Radio Location Station at Skrunda in Latvia which had 2 pulsed-radar systems operating at 152 to 162 MHz, at 1250 kW, with pulse duration of 0.8 msec, interpulse interval of 41 msec and pulse repetition rate of 24.5 Hz. The average intensity at these areas was <10 µW/cm^2.	A. Romancuks (1996), Measurement of the intensity of the electromagnetic radiation from the Skrunda Radio Location Station. The Science of the total environment, 180 (1):51-56. Cited in "An Assessment of Potential Health Effects from Exposure to PAVE PAWS Low-Level Phased-Array Radiofrequency Energy" , Board on Radiation Effects Research (2005), http://books.nap.edu/openbook.php?record_id=11205&page=135

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900 µW/cm^2	**ICNIRP (1998), WHO, Public Exposure Guidelines at 1800 MHz**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
1,000 µW/cm^2	**FCC (USA) OET-65, Public Exposure Guidelines at 1800 MHz**	Powerwatch, International Guidance Levels, www.powerwatch.org.uk/gen/intguidance.asp
<1,000 – 4,500 µW/cm^2 (0–45 mW/cm^2)	**Beneficial effects noted** in transient, reversible and dose-dependent alterations in rates of blastic transformation of unstimulated lymphocytes of hamsters after 15 minutes of irradiation of 2.45 GHz CW field for 5 day period.	A.T. Huang, M.E. Engle, J.A. Elder, J.B. Kinn and T.R. Ward (1997), The effect of microwave radiation (2450 MHz) on the morphology and chromosomes of lymphocytes, Radio Science, 12, Supplement 6, pp. 173-177, cited by W.R. Adey, 1982.
<1,000 µW/cm^2	Change in bioelectric activity of human muscles during deep stages of hypnosis after 10-20 second exposure at 57-78 GHz	S.I. Gerashchenko, O.I. Pisanko and Yu.N. (1991) Mus'kin,. Some physiological reactions of organisms under the influence of EHF radiation. *Apparatniy kompleks 'Elektronika-KVCh' I yevo primenenie v meditsine.,* L.G. Gassanova,ed. Moscow, 156 pp. NPO 'Saturn, Kiev, pp. 65-71, cited by Kositsky et al 2001.
600 µW/cm^2 at 900 MHz – FCC Exposure Limit in USA (FCC OET65:1997-01 based on NCRP report No.86)		
1000 µW/cm^2 at 1800 MHz – FCC Exposure Limit in uncontrolled environment in USA (FCC OET65:1997-01 based on NCRP report No.86)		
1,000 µW/cm^2	**ODC activity increased up to 50% in human melanoma cells** (450-500 MHz at 16 Hz).	W.R. Adey et al., Studies on ornithine decarboxylase (ODC), an enzyme essential for cell growth through DNA synthesis, cited by B.B. Levitt (1995), *Electromagnetic Fields: A Consumer's Guide to the Issues and How to Protect Ourselves.*
1000 µW/cm^2 Occupational exposure (average)	**ICNIRP public guidance levels at 400 MHz (TETRA) and 28 V/m.** ICNIRP (& UK) Standard Guidance is based on power levels averaged over 6 minutes.	Alasdair Philips, Report 2213, Report regarding Microwave Emissions from the T-Mobile (UK) cellular telephone base station at James Stockdale Ltd, Ratten Row, Seamer, Nr Scarborough with respect to any possible adverse health effects. 24th July 2002
1000 µW/cm^2	At 2,450 MHz, maximum specific absorption rate (SAR) for energy of 2.0 W/kg occurs in outer 1.0cm of phantom head (dummy head used for testing).	H.N. Kritikos and H.P. Schwan (1972), Hot spots generated in conducting spheres by electromagnetic waves and biological implications. IEEE Transactions on Biomedical Engineering, 19 (1), 53-58. Cited by W.R. Adey (1982), 'Tissue Interactions with Nonionizing Electromagnetic Fields,' Physiological Reviews, 61(2), 435-51.
1000 µW/cm^2	At 918 MHz, energy absorption at centre of head is 0.45 W/kg.	W.R. Adey (1982), 'Tissue Interactions with Nonionizing Electromagnetic Fields,' Physiological Reviews, 61(2), 435-51.
2000 µW/cm^2	**Australian Standard public exposure level** – Australian Standard AS2772.1. (1990) **Radiofrequency Radiation Part 1: Maximum Exposure Levels -- 100 kHz to 300 GHz.** Sydney: Standards Australia.	
700-2,800 µW/cm^2	**EEG changes resembling those induced by hallucinogenic drugs noted in rabbits exposed to 9.3 GHz radiation for 5 minutes.** Change noted 10 minutes after exposure with decreased total integrated EEG lasting ≤15 minutes.	L. Goldstein and Z. Sisko (1974), A quantitative electroencephalographic study of the acute effects of X-band microwaves in rabbits. In: *Biological effects and health hazards of microwave radiation* (P. Czerski, Ed.), p. 128-133. Warsaw: Polish Medical Publishers. Cited by R.O. Becker and A.A. Marino (1982), *Electromagnetism & Life*, State University of New York Press, pp. 211, ISBN: 0873955609, www.ortho.lsuhsc.edu/Faculty/Marino/EL/ELTOC.html
1,000-5,000 µW/cm2 above 300MHz	The American National Standard Institution's voluntarily required limit for worker and public exposures as at 1989, cited by C.W. Smith and S. Best (1989).	
2,600 µW/cm^2	Maximum exposure in school with base station on roof. Maximum power density of 0.01 µW/cm^2 measured at two schools without nearby base stations.	A. Thansandote, G.B. Gajda and D.W. Lecuyer (1999), Radiofrequency radiation in five Vancouver schools: exposure standards not exceeded. Canadian Medical Association Journal, 161(10), pp. 1311-1312.
5,000 µW/cm^2	Increased bone marrow cellularity in mice exposed to a 2.88 GHz field (SAR 2.3 W/kg) for 80-400 hours – effect not noted at 10,000 µW/cm^2 indicating possible window effect.	H.A. Ragan and R.D. Philips (1978), Hematologic effects of mice exposed to pulsed and CW microwaves. In: Proc. Int. Union Radio Sci., Symp. On Biologic Effects of Electromagnetic Waves, Helsinki, p. 48, cited by W.R. Adey, 1982.

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5,500 µW/cm^2	**Exposing developing chick embryos to 428 MHz radiation for >20 days caused lethal and/or teratogenic effects and delayed hatching.**	K. Saito and K. Suzuki (1991), Lethal and teratogenic effects of long-term low-intensity radio frequency radiation at 428 MHz on developing chick embryo. Teratology, 43, pp. 609-614.
6400 µW/cm^2 Public exposure (peak)	**ICNIRP public guidance levels at 400 MHz (TETRA) and 28 V/m.** ICNIRP (& UK) Standard Guidance is based on power levels averaged over 6 minutes, cited by A. Philips 2002.	
2,640 µW/cm^2 at 400 MHz – General Public Exposure Limit in UK (NRPB, 1993) (TETRA operates at 400 MHz)		
3,300 µW/cm^2 at 900 MHz – old UK General Public Exposure Limit to June 2000). Now ICNIRP is used for 900 MHz		
31,000 ±5,000 µW/cm^2 (Peak values)	Exposure of BALB/c mice to 42.2 GHz fields (with peak specific absorption rate (SAR) at skin of 622±100 W/kg) for 30 minutes daily for 3 days found to ameliorate the immunosuppressive effects of cyclophosphamide (CPA) – a regularly used anticancer drug – by augmenting proliferation of splenocytes and altering activation and effector functions of $CD4^+$ T cells.	V. Makar, M. Logani, I. Szabo, and M. Ziskin (2003), Effect of Millimeter Waves on Cyclophosphamide Induced Suppression of T Cell Functions, Bioelectromagnetics 24:356–365.
4,000 µW/cm^2	**Threshold for neuroendocrine effects**	W.R. Adey (1982).
5,000 µW/cm^2	**FCC threshold in controlled environment.**	Luxorion, Electromagnetic radiations and your health, www.astrosurf.com/luxorion/qsl-em-radiation
6400 µW/cm^2 Public exposure (peak)	**ICNIRP (& UK) public guidance levels at 400 MHz (TETRA) and 28 V/m.** based on power levels averaged over 6 minutes.	A. Philips (2002), Report 2213, Report regarding Microwave Emissions from the T-Mobile (UK) cellular telephone base station at James Stockdale Ltd, Ratten Row, Seamer, Nr Scarborough with respect to any possible adverse health effects.
<10,000 µW/cm^2	**EHF EMR capable of changing functional condition of living organisms**	O.I. Pisanko, V.I. Pyasetskiy and Yu.N. Mus'kin (1991), Questions of hygienic standardization of EHF radiation. *Apparatniy kompleks 'Elektronika-KVCh' i yevo primenenie v meditsine.* L.G. Gassanova, ed. Moscow, 156 pp. NPO 'Saturn,' Kiev, pp. 18-24, cited by Kositsky et al., 2001.
10,000 µW/cm^2 at 1800 MHz	**Old UK General Public Exposure Limit to June 2000).** Now ICNIRP is used for 1800 MHz, cited by A. Firstenberg 2001.	
10,000 µW/cm^2	**Exposure level recommended as safe by the NRPB for the frequency range 30 to 30,000 MHz (as at 1991)** was **10 mW/cm^2** or, **1 mW hour/cm^2**, during any 1 hour period. The NRPB did not include considerations relevant to small children.	
10,000 µW/cm^2	**Molecular and genetic effects (thermal)**	W.R. Adey (1982).
10,000 µW/cm^2	Exposure to 2450 MHz radiation for 90 minutes produced activation of the hypothalamic-pituitary-adrenal axis and increased oestradiol in both virgin and pregnant rats, suggesting **microwaves may greatly stress pregnant organisms**.	H. Nakamura, T. Seto, H. Nagase, M. Yoshida, S. Dan and K. Ogino (1997), Effects of exposure to microwaves on cellular immunity and placental steroids in pregnant rats. Occup Environ Med 54(9), pp. 676-80, cited by A. Marino, www.niehs.nih.gov/emfrapid/extrmurabs/marino.html
10,000-30,000 µW/cm^2	Chickens exposed at pulse repetition rate of 8,000 pulses per sec and frequency of 16,000 Mc/s. **Birds all exhibited a startled reaction at radiation onset, sustained extensor activity of wings and legs also noted.** Similar findings obtained with pigeons and seagulls. **Note: ICNIRP levels are 200 µW/cm^2 at 400 MHz rising to 1000 µW/cm^2 at ≥ 2 GHz**	J.A. Tanner (1966), Effect of Microwave Radiation on Birds, Nature, pp. 636.
10,000 µW/cm^2	No detectable ocular damage to the eyes of rabbits and non-human primates after either single 8-hour exposure to 60 GHz CW radiation or five separate 4-hour exposures on consecutive days.	H.A. Kues, S.A. D'Anna, R. Osiander, W.R. Green and J.C. Monahan JC (1999), Absence of ocular effects after either single or repeated exposure to 10 mW/cm^2 from a 60 GHz CW source. Bioelectromagnetics 20(8), pp.463-473.
1000 –10,000 µW/cm^2	**Exposure limit in UK as at 2001.**	A. Firstenberg (2001).

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10,000 µW/cm^2	**US Occupational Safety and Health Administration's standard as at 1989**	C.W. Smith & S. Best (1989), Electromagnetic Man: Health & Hazard in the Electrical Environment, J.M. Dent & Sons Ltd., London, ISBN 0-460-86044-5.
13,300 µW/cm^2 (Average Power Density)	**Millimeter wave treatment (MMWT) is widely used in Eastern Europe. Among reported beneficial effects is suppression of melanoma growth.** Tests on mice injected with B16 melanoma cells used 15-minute exposures (at 61.22 GHz). 5 daily exposures found to suppress subcutaneous tumour growth if started 5 days after inoculation; though if course started on day 1 or day 10 following inoculations they were ineffective.	A.A. Radzievsky, O.V. Gordiienko, I. Szabo, S.I. Alekseev, and M.C. Ziskin (2004), Millimeter Wave-Induced Suppression of B16 F10 Melanoma Growth in Mice: Involvement of Endogenous Opioids, Bioelectromagnetics 25:466–473.
20,000-50,000 µW/cm^2	**Exposed chickens respond with escape or avoidance reactions within seconds of radiation onset.**	J. A. Tanner, C. Romero-Sierra and S. J. Davie (1967), Non-thermal Effects of Microwave Radiation on Birds, *Nature* 216, pp. 1139.
25,000 µW/cm^2	**Young chicks became weak** on entering pulsed 16 GHz fields. Some collapsed to cage floor (where field intensity shown was registered) until radiation switched off. Collapse time (5-20 seconds) varied with chicks' orientation in field. Induced panting continued briefly after field removed. Drowsiness also noted.	C. Romero-Sierra, J.A. Tanner, J. Bigu del Blanco (1973), Interaction of Electromagneticfields And Living Systems With Special Reference To Birds, Control Systems Laboratory, Division of Mechanical Engineering / Division de Génie Mécanique, Canada, Report LTR-CS-113, presented to International Symposium on Biological Effects and Health Hazards of MW Radiation, World Health Organization, Warsaw, October 1973, 37 pp.
28,000 µW/cm^2	**Teratogenic and tumour causing effects**	W.R. Adey (1982), 'Tissue Interactions with Nonionizing Electromagnetic Fields,' Physiological Reviews, 61(2), 435-51.
32,000 µW/cm^2 Occupational exposure (peak)	**ICNIRP public guidance levels at 400 MHz (TETRA) and 28 V/m.** ICNIRP (& UK) Standard Guidance is based on power levels averaged over 6 minutes.	Alasdair Philips, Report 2213, Report regarding Microwave Emissions from the T-Mobile (UK) cellular telephone base station at James Stockdale Ltd, Ratten Row, Seamer, Nr Scarborough with respect to any possible adverse health effects. 24th July 2002.
40,000-165,000 µW/cm^2	**Dogs avoid exposure to 2800 MHz radiation at these intensities**	S. Michaelson et al., (1958). The biological effects of microwave irradiation in the dog, Proc. Second Tri-Serv. Conf. on Biological Effects of Microwave Energy, Rome, New York, p.175, cited by A.S. Presman (1970), Electromagnetic fields and life, (Translated from Russian by F.L. Sinclair). Plenum Press, New York, ISBN 0-306-30395-7, 356pp.
45,000 µW/cm^2	**Dorsally stimulated adult birds exhibited behaviour ranging from immobility to initiation of both flight and collapse.** Contributory factors were found to be behaviour prior to exposure, area of bird radiated and bird's location.	C. Romero-Sierra, J.A. Tanner, J. Bigu del Blanco (1973), Interaction of Electromagneticfields And Living Systems With Special Reference To Birds, Control Systems Laboratory, Division of Mechanical Engineering / Division de Génie Mécanique, Canada, Report LTR-CS-113, presented to International Symposium on Biological Effects and Health Hazards of MW Radiation, World Health Organization, Warsaw, October 1973, 37 pp.
46,000 µW/cm^2 (average field intensity 0.152m above floor)	Birds exposed to 9.3 GHz radiation pulsed at 416 pps with 2.3 µsec pulse-width. **Collapse of wing and legs noted at start of irradiation. Birds align themselves to outside of field, with their outer side becoming paralysed. Some exhibit hyperactivity. Escape behaviour also noted.**	J.A. Tanner, C. Romero-Sierra and S.J. Davie (1967), *Non-thermal Effects of Microwave Radiation on Birds*, Nature, 216, (5120), pp. 1139.
50,000 µW/cm^2	**Almost total paralysis observed in chickens.** After 10-20 seconds irradiation pigeons and seagulls showed increased signs of distress noted through defecation, vocalisation and initiation to flight.	J.A. Tanner and C. Remero-Sierra (1974), Beneficial and harmful accelerated growth induced by the action of nonionizing radiation, Annals of New York Academy of Sciences 238, pp. 171-175.
60,000 µW/cm^2	Significant differences noted in EEG patterns of birds when exposed to microwave field modulated sinusoidally at 4 Hz in comparison to non-irradiated situations.	F. Villa, C. Romero-Sierra and J.A. Tanner (1972), Changes in EEG Patterns of Birds under Microwave Radiation. NRC, DME Control Systems Laboratory Technical Report, LTR-CS-56, January 1972.

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60,000 μW/cm^2	Increased diffusion rate of aqueous solutions of electrolytes through membranes noted under 10 GHz, CW microwave radiation, being most pronounced when electric field vector oriented perpendicular to plane of the membrane.	J. Bigu del Blanco, C. Romero-Sierra, J.A. Tanner and M.L. Bigu (1973), Progress Report on the Investigation of the Effects of Microwave Radiation on the Diffusion Rate of Electrolytes through Membranes II. NRC, DME Control Systems LTR-CS-73.
80,000 μW/cm^2	**Repeated 1 hour exposures (20-24 times) to 2.45 GHz fields caused lens opacities in the eyes of 1 of 11 rabbits tested** – other studies do not find evidence of cumulative effects.	R.L. Carpenter, E.S. Ferri and G.J. Hagan (1974), 'Assessing microwaves as a hazard to the eye – progress and problems,' Biologic Effects and Health Hazards of Microwave Radiation, P. Czerski, ed., Polish Medical Publications, Warsaw, p. 178-185, cited by W.R. Adey 1982.
100,000 μW/cm^2	**Repeated exposures caused lens opacities in the eyes of 4 of 10 rabbits tested** – other studies do not find evidence of cumulative effects. (Lens opacities of rabbits used as model for human cataract induction)	R.L. Carpenter, E.S. Ferri and G.J. Hagan (1974), 'Assessing microwaves as a hazard to the eye – progress and problems,' Biologic Effects and Health Hazards of Microwave Radiation, P. Czerski, ed., Polish Medical Publications, Warsaw, p. 178-185, cited by W.R. Adey 1982.
120,000 μW/cm^2	**Approximately two minutes exposure caused sudden wilting reaction in a Mimosa plant that died without reopening.**	J. A. Tanner and C. Remero-Sierra (1974), Beneficial and harmful accelerated growth induced by the action of nonionizing radiation, Annals of New York Academy of Sciences 238, pp. 171-175.
120,000 μW/cm^2	**Repeated exposures caused lens opacities in the eyes of 8 of 10 rabbits tested** – other studies do not find evidence of cumulative effects.	R.L. Carpenter, E.S. Ferri and G.J. Hagan (1974), 'Assessing microwaves as a hazard to the eye – progress and problems,' Biologic Effects and Health Hazards of Microwave Radiation, P. Czerski, ed., Polish Medical Publications, Warsaw, p. 178-185, cited by W.R. Adey 1982.
140,000-190,000 μW/cm^2	5-10 minutes exposures at 140,000-190,000 μW/cm^2 caused plants' primary leaves to wilt. **10-30 minute exposures of most plants to 190,000 μW/cm^2 irradiation caused permanent wilting.**	C. Romero-Sierra, J.A. Tanner, J. Bigu del Blanco (1973), Interaction of Electromagnetic fields And Living Systems with Special Reference To Birds, Control Systems Laboratory, Division of Mechanical Engineering / Division de Génie Mécanique, Canada, Report LTR-CS-113, presented to International Symposium on Biological Effects and Health Hazards of MW Radiation, World Health Organization, Warsaw, October 1973, 37 pp.

Annexe 6a

Electro-Magnetic Fields & Health
Over 900 Published Independent Scientific Studies

Source : www.emfacts.com

March 2006

Overveview

926 studies		N	Y	NA
EPIDEMIOLOGY	106	24	72	10
IN VIVO	270	82	181	7
IN VITRO	223	83	136	4
IN UTERO	28	5	23	0
HUMAN	126	34	81	11
DOSIMETRY	58	10	4	44
MISCELLANEOUS	102	15	18	69
50-60 Hz	13	2	11	0
Totals	**926**	**255**	**526**	**145**
%	100%	28%	**57%**	16%

766 studies (applicable criteria)		N	Y	NA
EPIDEMIOLOGY	106	24	72	10
IN VIVO	270	82	181	7
IN VITRO	223	83	136	4
IN UTERO	28	5	23	0
HUMAN	126	34	81	11
50-60 Hz	13	2	11	0
Totals	**766**	**230**	**504**	**32**
%	100%	30%	**66%**	4%

N = no biological effect

Y= biological effect

NA = not applicable

EPIDEMIOLOGY (106)

[N] **All-cause mortality among Belgian military radar operators: a 40-year controlled longitudinal study.** VIEW
Degrave E, Autier P, Grivegnee AR, Zizi M.
Eur J Epidemiol. 20(8):677-681, 2005

[N] **Association Of Health Problems With 50 -Hz Magnetic Fields In Human Adults Living Near Power Transmission Lines** VIEW
Beale I, Pearce NE, Booth RJ, Heriot SA
Journal of the Australasian College of Nutritional & Environmental Mediciine, Vol. 20 No.2 August 2001 **NOTE: 50/60 Hz study**

[N] **Brain Tumors and Salivary Gland Cancers Among Cellular Telephone Users** VIEW
Auvinen A, Hietanen M, Luukkonen R, Koskela R-S
Epidemiology 13:356-359, 2002

[N] **Cellular Telephone Use and Risk of Acoustic Neuroma** VIEW
Christensen HC , Schüz J, Kosteljanetz M, Poulsen HS, Thomsen J, Johansen J
Am J Epidemiol 159:277-283, 2004

[N] **Cellular telephone use and risk of intratemporal facial nerve tumor.** VIEW
Warren HG, Prevatt AA, Daly KA, Antonelli PJ
Laryngoscope 113(4):663-667, 2003

[N] **Cellular telephone use and time trends for brain, head and neck tumours.** VIEW
Cook A, Woodward A, Pearce N, Marshall C
NZ Med J. 116(1175):U457, 2003

[N] **Cellular Telephones and Cancer-a Nationwide Cohort Study in Denmark** VIEW
Johansen C, Boice JD, McLaughlin JK, Olsen JH,
J Natl Cancer Inst 93(3):203-207, 2001

[N] **Cellular telephones and risk for brain tumors: A population-based, incident case-control study** VIEW
Christensen, HC; Schüz, J; Kosteljanetz, M; Poulsen, HS; Boice, JD. Jr; McLaughlin, JK; Johansen, C.
Neurology 64: 1189-1195, 2005

[N] **Cellular-Telephone Use and Brain Tumors.** VIEW
Inskip PD, Tarone RE, Hatch EE, Wilcosky TC, Shapiro WR, Selker RG, Fine HA, Black PM, Loeffler JS, Linet MS,
N Engl J Med 344(2):79-86, 2001

[N] **Congenital malformations and exposure to high-frequency electromagnetic radiation among Danish physiotherapists.** VIEW
Larsen AI,
Scand J Work Environ Health 17(5):318-323, 1991

[N] **Epidemiologic analysis of mortality among Motorola employees.** VIEW
Morgan RW, Kelsh MA, Zhao K,
Presented in Chicago Illinois in December 1993

[N] **Gender ratio of offspring and exposure to shortwave radiation among female physiotherapists.** VIEW
Guberan E, Campana A, Faval P, Guberan M, Sweetnam PM, Tuyn JW, Usel M,
Scand J Work Environ Health 20(5):345-348, 1994

[N] **Gender-specific reproductive outcome and exposure to high-frequency electromagnetic radiation among physiotherapists.** VIEW
Larsen AI, Olsen J, Svane O,
Scand J Work Environ Health 17(5):324-329, 1991

[N] **Handheld cellular telephone use and risk of brain cancer** VIEW
Muscat JE, Malkin MG, Thompson S, Shore RE, Stellman SD, McRee D, Neugut AI, Wynder EL,
JAMA 284(23):3001-3007, 2000

[N] **Handheld cellular telephones and risk of acoustic neuroma.** VIEW
Muscat JE, Malkin MG, Shore RE,. Thompson S, Neugut AL, Stellman SD, Bruce J
Neurology 58:1304-1306, 2002

[N] **Hematologic changes in workers exposed to radio wave radiation** VIEW
Budinscak V, Goldoni J, Saric M,
Arh Hig Rada Toksikol 42(4):367-373, 1991

[N] **Long-term mobile phone use and brain tumor risk.** VIEW
Lonn S, Ahlbom A, Hall P, Feychting M
Am J Epidemiol. 161(6):526-535, 2005

[N] **Long-term sickness and mobile phone use** VIEW
Hallberg O, Johansson O.
J Aust Coll Nutr & Env med 23:11-12, 2004

[N] **Mobile phones and malignant melanoma of the eye** VIEW
Johansen C, Boice JD Jr, McLaughlin JK, Christensen HC, Olsen JH
Brit J Cancer 86:348-349, 2002

[N] **No association between the use of cellular or cordless telephones and salivary gland tumours.** VIEW
Hardell L, Hallquist A, Hansson Mild K, Carlberg M, Gertzen H, Schildt EB, Dahlqvist A
Occup Environ Med. 61(8):675-679, 2004

[N] **Prevalence of mobile phone use while driving vehicles** VIEW
Astrain I, Bernaus J, Claverol J, Escobar A, Godoy P
Gac Sanit 17(1):66-69, 2003

[N] **Radiofrequency exposure and mortality from cancer of the brain and lymphatic/hematopoietic systems.** VIEW
Morgan RW, Kelsh MA, Zhao K, Exuzides KA, Heringer S, Negrete W,
Epidemiology 11(2):118-127, 2000

[N] **The anatomical distribution of cerebral gliomas in mobile phone users.** VIEW
Kahn AA, O'Brien DF, Kelly P, Phillips JP, Rawluk D, Bolger C, Pidgeon CN
Ir Med J. 96(8):240-242, 2003

[N] **The effects of radiofrequency (< 30 MHz) radiation in humans** VIEW
Zhao Z, Zhang S, Zho H, Zhang S, Su J, Li L,
Rev Environ Health 10(3-4):213-215, 1994

[NA] **Environmental risk factors for non-Hodgkin's lymphoma: a population-based case-control study in Languedoc-Roussillon, France.** VIEW
Fabbro-Peray P, Daures JP, Rossi JF.
Cancer Causes Control 12(3):201-212, 2001

[NA] **Incidence trends of adult primary intracerebral tumors in four Nordic countries.** VIEW
Lonn S, Klaeboe L, Hall P, Mathiesen T, Auvinen A, Christensen HC, Johansen C, Salminen T, Tynes T, Feychting M
Int J Cancer. 108(3):450-455, 2004

[NA] **Intensity of mobile phone use and health compromising behaviours: how is information and communication technology connected to health-related lifestyle in adolescence?** VIEW
Leena K, Tomi L, Arja RR.
J Adolesc. 28(1):35-47, 2005

[NA] **Mobile telephone use among Melbourne drivers: a preventable exposure to injury risk.** VIEW
Taylor DM, Bennett DM, Carter M, Garewal D
Med J Aust. 179(3):140-142, 2003

[NA] **Psychological predictors of problem mobile phone use.** VIEW
Bianchi A, Phillips JG.
Cyberpsychol Behav. 8(1):39-51, 2005

[NA] **Public perception of risk concerning cell towers and mobile phones.** VIEW
Hutter HP, Moshammer H, Wallner P, Kundi M
Soz Praventivmed. 49(1):62-66, 2004

[NA] **Review of extensive workups of 34 patients overexposed to radiofrequency radiation.** VIEW
Reeves GI
Aviat Space Environ Med 71(3):206-215, 2000

[NA] **Selection bias due to differential participation in a case-control study of mobile phone use and brain tumors.** VIEW
Lahkola A, Salminen T, Auvinen A.
Ann Epidemiol. 15(5):321-325, 2005

[NA] **Utility of telephone company records for epidemiologic studies of cellular telephones.** VIEW
Funch DP, Rothman KJ, Loughlin JE, Dreyer NA,
Epidemiology 7(3):299-302, 1996

[NA] **Validation of self-reported cellular phone use** VIEW
Samkange-Zeeb F, Berg G, Blettner M.
J Expo Anal Environ Epidemiol. 14(3):245-248, 2004

[Y] **A pooled analysis of magnetic fields, wire codes and childhood leukemia** VIEW
Greenland S, Sheppard AR, Kaune WT, Poole C, Kelsh MA
Epidemiology, October 2000, Volume 11, Number 6 2000 **NOTE: 50/60 Hz study**

[Y] **Adult and childhood leukemia near a high-power radio station in Rome, Italy** VIEW
Michelozzi P, Capon A, Kirchmayer U, Forastiere F, Biggeri A, Barca A, Perucci CA
Am J Epidemiol 155(12):1096-1103, 2002

[Y] **Alteration of diurnal rhythms of blood pressure and heart rate to workers exposed to radiofrequency electromagnetic fields.** VIEW
Szmigielski S, Bortkiewicz A, Gadzicka E, Zmyslony M, Kubacki R
Blood Press Monit 3(6):323-330, 1998

[Y] **Ambulatory ECG monitoring in workers exposed to electromagnetic fields.** VIEW
Bortkiewicz A, Zmyslony M, Gadzicka E, Palczynski C, Szmigielski S
J Med Eng Technol 21(2):41-46, 1997

[Y] **Cancer in Radar Technicians Exposed to RF/Microwave Radiation: Sentinel Episodes.** VIEW
Richter E, Berman T, Ben-Michael E, Laster R, Westin JB
Int J Occup Environ Health 6(3):187-193, 2000

[Y] **Cancer incidence and mortality and proximity to TV towers** VIEW
Hocking B, Gordon IR, Grain HL, Hatfield GE,
Med J Aust 165(11-12):601-605, 1996

[Y] **Cancer incidence near radio and television transmitters in Great Britain. I. Sutton Coldfield transmitter** VIEW
Dolk H, Shaddick G, Walls P, Grundy C, Thakrar B, Kleinschmidt I, Elliott P,
Am J Epidemiol 145(1):1-9, 1997

[Y] **Cancer incidence near radio and television transmitters in Great Britain. II. All high power transmitters.** VIEW
Dolk H, Elliott P, Shaddick G, Walls P, Thakrar B,
Am J Epidemiol 145(1):10-17, 1997

[Y] **Cancer morbidity in subjects occupationally exposed to high frequency (radiofrequency and microwave) electromagnetic radiation.** VIEW
Szmigielski S
Sci Total Environ 180(1):9-17, 1996

[Y] **Case-control study of the association between the use of cellular and cordless telephones and malignant brain tumors diagnosed during 2000-2003** VIEW
Hardell L, Carlberg M, Mild K.
Environmental Research 2005

[Y] **Case-Control Study on Cellular and Cordless Telephones and the Risk for Acoustic Neuroma or Meningioma** VIEW
Hardell L, Carlberg M, Hansson Mild K
Neuroepidemiology 25:120-128, 2005

[Y] **Case-control study on radiology work, medical X-ray investigations, and use of cellular telephones as risk factors for brain tumors** VIEW
Hardell L, Nasman A, Pahlson A, Hallquist A
Medscape General Medicine May 4, 2000

[Y] **Case-control study on risk factors for testicular cancer.** VIEW
Hardell L, Nasman A, Ohlson CG, Fredrikson M
Int J Oncol 13(6):1299-1303, 1998

[Y] **Cellular and cordless telephones and the risk for brain tumours.** VIEW
Hardell L, Hallquist A, Hansson Mild K, Carlberg M, Pahlson A, Lilja A.
Europ J Cancer Prevent 11:377-386, 2002

[Y] **Cluster of testicular cancer in police officers exposed to hand-held radar.** VIEW
Davis RL, Mostofi FK,
Am J Ind Med 24(2):231-233, 1993

[Y] **Comparison of chromosome aberrations in peripheral blood lymphocytes from people occupationally exposed to ionizing and radiofrequency radiation.** VIEW
Lalic H, Lekic A, Radosevic-Stasic B
Acta Med Okayama 55(2):117-127, 2001

[Y] **Comparison of symptoms experienced by users of analogue and digital mobile phones: a Swedish-Norwegian epidemiological study.** VIEW
Haugsdal B, Hauger E, Mild KH, Oftedal G, Sandstrom M, Wilen J, Tynes T
Arbetslivsrapport 23: 1998

[Y] **Conversation limits the functional field of view.** VIEW
Atchley P, Dressel J.
Hum Factors. 46(4):664-673, 2004

[Y] **Decreased survival for childhood leukaemia in proximity to TV towers** VIEW
Hocking B, Gordon I,
Presented at the Annual Scientific Meeting of the Royal Australasian College of Physicians in Adelaide, SA, 2-5 May 2000

[Y] **Ecological study on residences in the vicinity of AM radio broadcasting** VIEW
Sue Kyung Park, Mina Ha and Hyung-Jun Im
International Archives of Occupational and Environmental Health Published online: 31 July 2004

[Y] **Effects of ultrasound, shortwaves, and physical exertion on pregnancy outcome in physiotherapists.** VIEW
Taskinen H, Kyyronen P, Hemminki K,
J Epidemiol Community Health 44(3):196-201, 1990

[Y] **Epidemiological study of cellular telephone use and malignant brain tumors.** VIEW
Muscat J
Presented at the WTR Second State of the Science Colloquium in Long Beach California 1999

[Y] **Further aspects on cellular and cordless telephones and brain tumours.** VIEW
Hardell L, Mild KH, Carlberg M
Int J Oncol 22(2):399-407, 2003

[Y] **Headaches from cellular telephones: are they real and what are the implications?** VIEW
Frey AH
Environ Health Perspect 106(3):101-103, 1998

[Y] **Health status of personnel occupationally exposed to radiowaves.** VIEW
Goldoni J, Durek M, Koren Z,
Arh Hig Rada Toksikol 44(3):223-228, 1993

[Y] **Hearing level and intensive use of mobile phones** VIEW
Garcia Callejo FJ, Garcia Callejo F, Pena Santamaria J, Alonso Castaneira I, Sebastian Gil E, Marco Algarra J.
Acta Otorrinolaringol Esp. 56(5):187-191, 2005

[Y] **Heart rate variability in workers exposed to medium-frequency electromagnetic fields.** VIEW
Bortkiewicz A, Gadzicka E, Zmyslony M,
J Auton Nerv Syst 59(3):91-97, 1996

[Y] **Historical evidence that residential electrification caused the emergence of the childhood leukemia peak** VIEW
Milham S, Ossiander EM
Medical Hypotheses, Harcourt Publishers Ltd, April 2001 **NOTE: 50/60 Hz study**

[Y] **Incidence of breast cancer in Norwegian female radio and telegraph operators** VIEW
Tynes T, Hannevik M, Andersen A, Vistnes AI, Haldorsen T
Cancer Causes Control 7(2):197-204, 1996

[Y] **Incidence of cancer in the vicinity of Korean AM radio transmitters.** VIEW
Ha M, Lim HJ, Cho SH, Choi HD, Cho KY
Arch Environ Health. 58(12):756-762, 2003

[Y] **Increased incidence of cancer near a cell-phone transmitter station** VIEW
Wolf R, Wolf D.
Inter J Cancer Prev 1(2):123-128, 2004

[Y] **Intraocular melanoma linked to occupations and chemical exposures** VIEW
Holly EA, Aston DA, Ahn DK, Smith AH
Epidemiology 7(1):55-61, 1996

[Y] **Ionizing radiation, cellular telephones and the risk of brain tumours.** VIEW
Hardell L, Hansson Mild K, Pahlson A, Hallquist A,
Europ J Cancer Prevent 10:523-529, 2001

[Y] **Ionizing radiation, cellular telephones and the risk of brain tumours.** VIEW
Hardell L, Hansson Mild K, Pahlson A, Hallquist A,
Europ J Cancer Prevent 10:523-529, 2001

[Y] **Levels of immunoglobulin and subpopulations of T lymphocytes and NK cells in men occupationally exposed to microwave radiation in frequencies of 6-12 GHz** VIEW
Dmoch A, Moszczynski P,
Med Pr 49(1):45-49, 1998

[Y] **Melanoma incidence and frequency modulation (FM) broadcasting.** VIEW
Hallberg O, Johansson O.
Arch Environ Health. 57(1):32-40, 2002

[Y] **Miscarriages among female physical therapists who report using radio- and microwave-frequency electromagnetic radiation.** VIEW

Ouellet-Hellstrom R, Stewart WF
Am J Epidemiol 138(10):775-786, 1993

[Y] **Mobile phone related-hazards and subjective hearing and vision symptoms in the Saudi population.** VIEW
Meo SA, Al-Drees AM
Int J Occup Med Environ Health. 18(1):53-57, 2005

[Y] **Mobile phone use and risk of acoustic neuroma: results of the Interphone case-control study in five North European countries.** VIEW
Schoemaker MJ, Swerdlow AJ, Ahlbom A, Auvinen A, Blaasaas KG, Cardis E, Collatz Christensen H, Feychting M, Hepworth SJ, Johansen C, Klæboe L, Lönn S, McKinney PA, Muir K, Raitanen J, Salminen T, Thomsen J, Tynes T
British Journal of Cancer (advance online publication) 30 August 2005

[Y] **Mobile phone use and subjective symptoms. Comparison of symptoms experienced by users of analogue and digital mobile phones.** VIEW
Sandstrom M, Wilen J, Oftedal G, Hansson-Mild K,
Occup Med (Lond) 51(1):25-35, 2001

[Y] **Mobile Phone Use and the Risk of Acoustic Neuroma.** VIEW
Lonn S, Ahlbom A, Hall P, Feychting M
Epidemiology. 15(6):653-659, November 2004

[Y] **Mortality of plastic-ware workers exposed to radiofrequencies.** VIEW
Lagorio S, Rossi S, Vecchia P, De Santis M, Bastianini L, Fusilli M, Ferrucci E, Comba P
Bioelectromagnetics 18(6):418-421, 1997

[Y] **Motor and psychological functions of school children living in the area of the Skrunda Radio Location Station in Latvia.** VIEW
Kolodynski AA, Kolodynska VV
Sci Total Environ 180(1):87-93, 1996

[Y] **Non-Hodgkin's lymphomas and occupation in Sweden** VIEW
Cano MI, Pollan M
Int Arch occup Environ Health 74: 443-449 2001

[Y] **Observations of changes in neurobehavioral functions in workers exposed to high-frequency radiation** VIEW
Duan L, Shan Y, Yu X
Chung Hua Yu Fang I Hsueh Tsa Chih 32(2):109-111, 1998

[Y] **Occupation and Risk of Non-Hodgkin¹s Lymphoma and Chronic Lymphocytic Leukemia** VIEW
Zheng T, Blair A, Zhang Y, Weisenburger DD, Zahm SH
J Occup Envir Med 44:469-474, 2002

[Y] **Overall mortality of cellular telephone customers.** VIEW
Rothman K, Loughlin J, Funch D, Dreyer N
Epidemiology 7 (3) 303-305 1996

[Y] **Overall mortality of cellular telephone customers.** VIEW
Rothman KJ, Loughlin JE, Funch DP, Dreyer NA,
Epidemiology 7(3):303-305, 1996

[Y] **Parental occupational exposures to electromagnetic fields and radiation and the incidence of neuroblastoma in offspring** VIEW
De Roos AJ, Teschke K, Savitz DA, Poole C, Grufferman S, Pollock BH, Olshan AF
Epidemiology 12(5):508-517, 2001

[Y] **Prevalence of headache among handheld cellular telephone users in Singapore:** VIEW
Chia SE, Chia HP, Tan JS,
Environ Health Perspect 108(11):1059-1062, 2000

[Y] **Profiles in driver distraction: effects of cell phone conversations on younger and older drivers.** VIEW
Strayer DL, Drews FA.
Hum Factors. 46(4):640-649, 2004

[Y] **Radiation exposure, socioeconomic status, and brain tumor risk in the US Air Force: a nested case-control study.** VIEW
Grayson JK
Am J Epidemiol 143(5):480-486, 1996

[Y] **Risk of leukemia and residence near a radio transmitter in Italy.** VIEW
Michelozzi P, Ancona C, Fusco D, Forastiere F, Perucci CA
Epidemiology 9 (Suppl) 354p, 1998

[Y] **Risk of leukemia in residences near a radio transmitter in Italy.** VIEW
Michelozzi P, Ancona C, Fusco D, Forastiere F, Perucci CA
Epidemiology 9 (Suppl) 354p, 1998

[Y] **Semen analysis of military personnel associated with military duty assignments.** VIEW
Weyandt TB, Schrader SM, Turner TW, Simon SD
Reprod Toxicol 10(6):521-528, 1996

[Y] **Semen analysis of personnel operating military radar equipment.** VIEW
Hjollund NH, Bonde JP, Skotte J,
Reprod Toxicol 11(6):897, 1997

[Y] **Semen quality and hormone levels among radiofrequency heater operators.** VIEW
Grajewski B, Cox C, Schrader SM, Murray WE, Edwards RM, Turner TW, Smith JM, Shekar SS, Evenson DP, Simon SD, Conover DL,
J Occup Environ Med 42(10):993-1005, 2000

[Y] **Some ocular symptoms and sensations experienced by long term users of mobile phones.** VIEW
Balik HH, Turgut-Balik D, Balikci K, Ozcan IC.
Pathol Biol (Paris). 53(2):88-91, 2005

[Y] **Study of the health of people living in the vicinity of mobile phone base stations: I. Influence of distance and sex** VIEW
Santini R, Santini P, Danze JM, Le Ruz P, Seigne M
Pathol Biol (Paris) 50(6):369-373, 2002

[Y] **Subjective symptoms among mobile phone users-A consequence of absorption of radiofrequency fields?** VIEW
Wilen J, Sandstrom M, Hansson Mild K.
Bioelectromagnetics 24(3):152-159, 2003

[Y] **Survey study of people living in the vicinity of cellular phone base stations.** VIEW
Santini R, Santini P, Le Ruz P, Danze JM, Seigne M
Electromag Biol Med 22:41-49, 2003

[Y] **Symptoms experienced in connection with mobile phone use.** VIEW
Oftedal G, Wilen J, Sandstrom M, Mild KH,
Occup Med (Lond) 50(4):237-245, 2000

[Y] **The effect of male occupational exposure in infertile couples in Norway.** VIEW
Irgens A, Kruger K, Ulstein M,
J Occup Environ Med 41(12):1116-1120, 1999

[Y] **The effect of various occupational exposures to microwave radiation on the concentrations of immunoglobulins and T lymphocyte subsets** VIEW
Moszczynski P, Lisiewicz J, Dmoch A, Zabinski Z, Bergier L, Rucinska M, Sasiadek U,
Wiad Lek 52(1-2):30-34, 1999

[Y] **The influence of electromagnetic fields on human brain activity.** VIEW
Reiser H, Dimpfel W, Schober F
Eur J Med Res 1995 Oct 16;1(1):27-32 1995

[Y] **The Microwave Syndrome: A Preliminary Study in Spain** VIEW
Navarro EA, Segura J, Portolés M, Gómez-Perretta de Mateo C
Electromag. Biol. Med. 22:161-169, 2003

[Y] **The Microwave Syndrome: A Preliminary Study in Spain.** VIEW
Navarro EA, Sequra J, Portoles M, Gomez-Perretta de Mateo C.
Electromag Biol Med 22:161-169, 2003

[Y] **The possible role of radiofrequency radiation in the development of uveal melanoma.** VIEW
Stang A, Anastassiou G, Ahrens W, Bromen K, Bornfeld N, Jockel KH,
Epidemiology 12(1):7-12, 2001

[Y] **Use of cellular or cordless telephones and the risk for non-Hodgkin's lymphoma.** VIEW
Hardell L, Eriksson M, Carlberg M, Sundstrom C, Mild KH
Int Arch Occup Environ Health. Jul 5;:1-8 2005

[Y] **Use of cellular telephones and brain tumour risk in urban and rural areas.** VIEW
Hardell L, Carlberg M, Hansson Mild K.
Occup Environ Med 62:390-394, 2005

[Y] **Use of cellular telephones and the risk for brain tumours: A case-control study.** VIEW
Hardell L, Nasman A, Pahlson A, Hallquist A, Mild KH
Int J Oncol 15(1):113-116, 1999

[Y] **Vestibular schwannoma, tinitus and cellular telephones.** VIEW
Hardell L, Mild KH, Sandstrom M, Carlberg M, Hallquist A, Pahlson A
Neuroepidemiol 22:124-129, 2003

IN VIVO (270)

[N] **1439 MHz pulsed TDMA fields affect performance of rats in a T-maze task only when body temperature is elevated.** VIEW
Yamaguchi H, Tsurita G, Ueno S, Watanabe S, Wake K, Taki M, Nagawa H
Bioelectromagnetics 24(4):223-230, 2003

[N] **2.45 GHz EMF does not alter radial-maze performance in rats.** VIEW
Cassel JC, Cosquer B, Galani R, Kuster N.
Behav Brain Res. 155(1):37-43, 2004

[N] **Absence of a synergistic effect between moderate-power radio-frequency electromagnetic radiation and adriamycin on cell-cycle progression and sister-chromatid exchange.** VIEW
Ciaravino V, Meltz ML, Erwin DN,
Bioelectromagnetics 12(5):289-298, 1991

[N] **Absence of ocular effects after either single or repeated exposure to 10 mW/cm^2 from a 60 GHz CW source** VIEW
Kues HA, D'Anna SA, Osiander R, Green WR, Monahan JC
Bioelectromagnetics 20(8):463-473, 1999

[N] **Acute low-level microwave exposure and central cholinergic activity: studies on irradiation parameters.** VIEW
Lai H, Horita A, Guy AW
Bioelectromagnetics. 1988. 9(4). P 355-62. 1988

[N] **Blood-brain barrier and electromagnetic fields: Effects of scopolamine methylbromide on working memory after whole-body exposure to 2.45GHz microwaves in rats.** VIEW
Cosquer B, Vasconcelos AP, Frohlich J, Cassel JC
Behav Brain Res. 161(2):229-237, 2005

[N] **Brain tumour development in rats exposed to electromagnetic fields used in wireless cellular communication.** VIEW
Salford LG, Brun A, Persson BRR,
Wireless Network 3: 463-469, 1997

[N] **Cerebro-biological effects in low-frequency pulsed RF fields.** VIEW
Spittler JF, Calbrese P, Gahlen W, Heidrich M
Presented at the Second World Congress, Bologna, Italy 1997; published Edition Wissenschaft Nr.12a 1996

[N] **Changes in gastric electric activity and serum catecholamine level under the influence of electromagnetic microwaves** VIEW
Kulkybaev GA, Pospelov NI
Med Tr Prom Ekol (5):8-11, 2000

[N] **Chronic exposure to a 1.439 GHz electromagnetic field** VIEW
Shirai T, Kawabe M, Ichihara T, Fujiwara O, Taki M, Watanabe SI, Wake K, Yamanaka Y, Imaida K, Asamoto M, Tamano S.
Bioelectromagnetics 26:59-68, 2005

[N] **Chronic Exposure to a GSM-like Signal (Mobile Phone)** VIEW
Bartsch H, Bartsch C, Seebald E, Deerberg F, Dietz K, Vollrath L, Mecke D.
Radiat Res 157(2):183-190, 2002

[N] **Chronic, low-level (1.0 W/kg) exposure of mice prone to mammary cancer to 2450 MHz microwaves.** VIEW
Frei MR, Jauchem JR, Dusch SJ, Merritt JH, Berger RE, Stedham MA
Radiat Res 150(5):568-576, 1998

[N] **Detection of DNA damage by the alkaline comet assay after exposure to low-dose gamma radiation.** VIEW
Malyapa RS, Bi C, Ahern EW, Roti Roti JL,
Radiat Res 149(4):396-400, 1998

[N] **DNA damage in rat brain cells after in vivo exposure to 2450 MHz electromagnetic radiation and various methods of euthanasia** VIEW
Malyapa RS, Ahern EW, Bi C, Straube WL, LaRegina M, Pickard WF, Roti Roti JL,
Radiat Res 149(6):637-645, 1998

[N] **DNA damage in rat brain cells following In Vivo exposure to 2450 MHz EMR and methods of euthanesia** VIEW
Malyapa RS, Ahern EW, Starube WL, Moros EG, Pickard WR, Roti-Roti JL
Radiation Research 149: 637-646 1998

[N] **Does head-only exposure to GSM-900 electromagnetic fields affect the performance of rats in spatial learning tasks?** VIEW
Dubreuil D, Jay T, Edeline JM.
Behav Brain Res 129(1-2):203-210, 2002

[N] **Effect of chronic microwave radiation on T cell-mediated immunity in the rabbit.** VIEW
Nageswari KS, Sarma KR, Rajvanshi VS, Sharan R, Sharma M, Barathwal V, Singh V
Int J Biometeorol 35(2):92-97, 1991

[N] **Effect of Immobilization and Concurrent Exposure to a Pulse-Modulated Microwave Field** VIEW
Stagg RB, Hawel LH III, Pastorian K, Cain C, Adey WR, Byus CV,
Radiat Res 155(4):584-592, 2001

[N] **Effect of long-term mobile communication microwave exposure on vascular permeability in mouse brain.** VIEW
Finnie JW, Blumbergs PC, Manavis J, Utteridge TD, Gebski V, Davies RA, Vernon-Roberts B, Kuchel TR.
Pathology 34(4):344-347, 2002

[N] **Effect of millimeter wave radiation on catalase activity** VIEW
Logani MK, Agelan A, Ziskin MC
Electromag. Biol. Med. 21:303-308, 2002

[N] **Effects of 1-Week and 6-Week Exposure to GSM/DCS Radiofrequency Radiation on Micronucleus Formation in B6C3F1 Mice.** VIEW
Gorlitz BD, Muller M, Ebert S, Hecker H, Kuster N, Dasenbrock C.
Radiat Res. 164(4):431-439, 2005

[N] **Effects of 2.45-GHz microwave radiation and DMH-induced colon cancer in mice.** VIEW
Wu RY, Chiang H, Shao BJ, Li NG, Fu YD,
Unknown possibly 1999

[N] **Effects of a 60 Hz magnetic field on central cholinergic systems of the rat.** VIEW
Lai H, Carino MA, Horita A. Guy AW
Bioelectromagnetics. 1993. 14(1). P 5-15. 1993

[N] **Effects of chronic exposure of electromagnetic fields from mobile phones on hearing in rats.** VIEW
Kizilay A, Ozturan O, Erdem T, Tayyar Kalcioglu M, Cem Miman M
Auris Nasus Larynx. 30(3):239-245, 2003

[N] **Effects of exposure of the ear to GSM microwaves: in vivo and in vitro experimental studies.** VIEW
Aran JM, Carrere N, Chalan Y, Dulou PE, Larrieu S, Letenneur L, Veyret B, Dulon D.
Int J Audiol. 43(9):545-554, 2004

[N] **Effects of GSM-900 microwaves on the experimental allergic encephalomyelitis (EAE) rat model of multiple sclerosis.** VIEW
Anane R, Geffard M, Taxile M, Bodet D, Billaudel B, Dulou PE, Veyret B
Bioelectromagnetics 24(3):211-213, 2003

[N] **Effects of In Vivo Exposure to GSM-Modulated 900 MHz Radiation on Mouse Peripheral Lymphocytes.** VIEW
Gatta L, Pinto R, Ubaldi V, Pace L, Galloni P, Lovisolo GA, Marino C, Pioli C
Radiat Res. 160(5):600-605, 2003

[N] **Effects of microwaves (900 MHz) on the cochlear receptor: exposure systems and preliminary results.** VIEW
Marino C, Cristalli G, Galloni P, Pasqualetti P, Piscitelli M, Lovisolo GA ,
Radiat Environ Biophys 39(2):131-136, 2000

[N] **Effects of Mobile Phone Radiation on X-Ray-Induced Tumorigenesis in Mice.** VIEW
Heikkinen P, Kosma VM, Hongisto T, Huuskonen H, Hyysalo P, Komulainen H, Kumlin T, Lahtinen T, Lang S, Puranen L, Juutilainen J.
Radiat Res 156(6):775-785, 2001

[N] **Effects of pulsed microwave radiation pre-and postnatally on the developing brain in mice.** VIEW
Chiang H, Yao GD
J Bioelectricity 6:197-204, 1987

[N] **Effects on human of microwaves emitted by GSM-type mobile telephones:Chronobiological rhythm of ACTH.** VIEW
deSeze R, Albetin V, Rouzier-Panis R, Fabbro-Peray P, Toulton Y, Miro L,
Presented at BEMS in Victoria, British Columbia 1996

[N] **Electromagnetic Fields from Mobile Phones do not Affect the Inner Auditory System of Sprague-Dawley Rats.** VIEW
Galloni P, Parazzini M, Piscitelli M, Pinto R, Lovisolo GA, Tognola G, Marino C, Ravazzani P.
Radiat Res. 164(6):798-804, 2005

[N] **Experimental research on the biological action of the pulse-modulated microwave radiation created by shipboard radar stations** VIEW
Kaliada TV, Nikitina VN, Liashko GG, Masterova Ilu, Shaposhnikova ES,
Med Tr Prom Ekol (11):15-17, 1995

[N] **Frequency of micronuclei in the blood and bone marrow cells of mice exposed to ultra-wideband electromagnetic radiation.** VIEW
Vijayalaxmi, Seaman RL, Belt ML, Doyle JM, Mathur SP, Prihoda TJ
Int J Radiat Biol 75(1):115-120, 1999

[N] **Image content influences men¹s semen quality.** VIEW
Kilgallon SJ, Simmons LW
Biol Lett 2005 (doi:10.1098/rsbl.2005.0324) 2005

[N] **Immediate post-exposure effects of high-peak-power microwave pulses on operant behavior of Wistar rats.** VIEW
Akyel Y, Hunt EL, Gambrill C, Vargas C Jr
Bioelectromagnetics 12(3):183-195, 1991

[N] **In vivo exposure of rats to GSM-modulated microwaves: flow cytometry analysis of lymphocyte subpopulations and of mitogen stimulation.** VIEW
Chagnaud JL, Veyret B,
Int J Radiat Biol 75(1):111-113, 1999

[N] **Incidence of spontaneous and nitrosourea-induced primary tumors in the central nervous system** VIEW
Adey WR, Byus CV, Cain CD, Higgins RJ, Keau CJ, Kuster N, MacMurray A, Stagg RB, Zimmerman G, Phillips JL, Haggren W
Presented at 1997 Second World Congress for Electricity and Magnetism in Biology and Medicine in Bologna, Italy, and 1999 URSI 26th General Assembly in Toronto, Canada -- 1997

[N] **Influence of EMP on the nervous system of rats** VIEW
Wu YZ, Jia YF, Guo Y, Zheng ZX:
Acta Biophysica Sinica 15:152-157, 1999

[N] **Intraseptal microinjection of beta-funaltrexamine blocked a microwave-induced decrease of hippocampal cholinergic activity in the rat.** VIEW
Lai H, Carino MA, Horita A. Guy AW
Pharmacol-Biochem-Behav. 1996 Mar. 53(3). P 613-6. 1996

[N] **Japanese encephalitis virus (JEV): potentiation of lethality in mice by microwave radiation.** VIEW
Lange DG, Sedmak J
Bioelectromagnetics 12(6):335-348, 1991

[N] **Lack of behavioral effects in non-human primates after exposure to ultrawideband electromagnetic radiation in the microwave frequency range.** VIEW
Sherry CJ, Blick DW, Walters TJ, Brown GC, Murphy MR,
Radiat Res 143(1):93-97, 1995

[N] **Lack of behavioral effects in the rhesus monkey: high peak microwave pulses at 1.3 GHz.** VIEW
D'Andrea JA, Cobb BL, de Lorge JO,
Bioelectromagnetics 10(1):65-76, 1989

[N] **Lack of effect of 94 GHz radio frequency radiation exposure in an animal model of skin carcinogenesis** VIEW
Mason PA, Walters TJ, DiGiovanni J, Beason CW, Jauchem JR, Dick EJ Jr, Mahajan K, Dusch SJ, Shields BA, Merritt JH, Murphy MR, Ryan KL
Carcinogenesis 22(10):1701-1708, 2001

[N] **Lack of effects of 1439 MHz electromagnetic near field exposure on the blood-brain barrier in immature and young rats.** VIEW
Kuribayashi M, Wang J, Fujiwara O, Doi Y, Nabae K, Tamano S, Ogiso T, Asamoto M, Shirai T.
Bioelectromagnetics. Sep 2; 2005

[N] **Lack of effects on heart rate and blood pressure in ketamine-anesthetized rats briefly exposed to ultra-wideband electromagnetic pulses.** VIEW
Jauchem JR, Frei MR, Ryan KL, Merritt JH, Murphy MR
IEEE Trans Biomed Eng 46(1):117-120, 1999

[N] **Long-Term Exposure of E&mgr;-Pim1 Transgenic Mice to 898.4 MHz Microwaves does not Increase Lymphoma Incidence.** VIEW
Utteridge TD, Gebski V, Finnie JW, Vernon-Roberts B, Kuchel TR
Radiat Res 158(3):357-364, 2002

[N] **Long-term, low-level microwave irradiation of rats.** VIEW
Chou CK, Guy AW, Kunz LL, Johnson RB, Crowley JJ, Krupp JH,
Bioelectromagnetics 13(6):469-496, 1992

[N] **Low-level exposure to pulsed 900 MHz microwave radiation does not cause deficits in the performance of a spatial learning task in mice.** VIEW
Sienkiewicz ZJ, Blackwell RP, Haylock RG, Saunders RD, Cobb BL
Bioelectromagnetics 21(3):151-158, 2000

[N] **Low-level exposure to pulsed 900 MHz microwave radiation does not cause deficits in the performance of a spatial learning task in mice.** VIEW
Sienkiewicz ZJ, Blackwell RP, Haylock RG, Saunders RD, Cobb BL
Bioelectromagnetics 21(3):151-158, 2000

[N] **Measurement of DNA damage after acute exposure to pulsed-wave 2450 MHz microwaves in rat brain cells by two alkaline comet assay methods.** VIEW
Lagroye I, Anane R, Wettring BA, Moros EG, Straube WL, Laregina M, Niehoff M, Pickard WF, Baty J, Roti JL
Int J Radiat Biol. 80(1):11-20, 2004

[N] **Measurement of DNA damage following exposure to 2450 MHz EMR.** VIEW
Malyapa RS, Ahern EW, Straube WL, Moros EG, Pickard WF, Roti-Roti J
Radiation Research 148: 608-617 1997

[N] **Micronuclei in the peripheral blood and bone marrow cells of rats exposed to 2450 MHz radiofrequency radiation** VIEW
Vijayalaxmi, Pickard WF, Bisht KS, Prihoda TJ, Meltz ML, LaRegina MC, Roti Roti JL, Straube WL, Moros EG
Int J Radiat Biol 77(11):1109-1115, 2001

[N] **Microwave ablation of the atrioventricular junction in open-chest dogs.** VIEW
Lin JC, Beckman KJ, Hariman RJ, Bharati S, Lev M, Wang YJ,
Bioelectromagnetics. 16(2):97-105, 1995

[N] **Microwave catheter ablation of the atrioventricular junction in closed-chest dogs** VIEW
Lin JC, Hariman RJ, Wang YJ, Wang YG
Medical & Biological Engineering & Computing. 34(4):295-298, 1996

[N] **Modification of acoustic startle by microwave pulses in the rat: a preliminary report.** VIEW
Seaman RL, Beblo DA
Bioelectromagnetics 13(4):323-328, 1992

[N] **Nerve cell damage in mammalian brain after exposure to microwaves from GSM mobile phones.** VIEW
Salford LG, Brun AR, Eberhardt JL, Malmgren L, Persson BRR
Environ Health Persp Online January 29, 2003

[N] **Neurophyschological performance of healthy subjects under low-frequency pulsed RF fields.** VIEW
Calabrese P,
Presented at Second World Congress in Bologna, Italy 1997

[N] **No effect in humans of microwaves emitted by GSM and DCS mobile telephones on the chronobiological rhythms of melatonin.** VIEW
deSeze R, Ayoub J, Fabbro-Peray P, Touitou Y, Miro L,
Presented at 1997 Second World Congress in Bologna, Italy: Journal of Pineal Research, In press 1998

[N] **No effect of short-term exposure to GSM-modulated low-power microwaves on benzo(a)pyrene-induced tumours in rat.** VIEW
Chagnaud JL, Moreau JM, Veyret B,
Int J Radiat Biol 75(10):1251-1256, 1999

[N] **No effects of 900 MHz and 1800 MHz electromagnetic field emitted from cellular phone on nocturnal serum melatonin levels in rats.** VIEW
Koyu A, Ozguner F, Cesur G, Gokalp O, Mollaoglu H, Caliskan S, Delibas N.
Toxicol Ind Health. 21(1-2):27-31, 2005

[N] **No effects of GSM-modulated 900 MHz electromagnetic fields on survival rate and spontaneous development of lymphoma in female AKR/J mice** VIEW
Sommer AM, Streckert J, Bitz AK, Hansen VW, Lerchl A
BMC Cancer.;4(1):77 Nov 11 2004

[N] **No short-term effects of high-frequency electromagnetic fields on the mammalian pineal gland** VIEW
Vollrath L, Spessert R, Kratzsch T, Keiner M, Hollmann H
Bioelectromagnetics 18(5):376-387, 1997

[N] **Poly ADP ribosylation as a possible mechanism of microwave--biointeraction.** VIEW
Singh N, Rudra N, Bansal P, Mathur R, Behari J, Nayar U,
Indian J Physiol Pharmacol 38(3):181-184, 1994

[N] **Quantitative patterns in the cytogenetic action of microwaves** VIEW
Koveshnikov IV, Antipenko EN
Radiobiologiia 31(1):149-151, 1991

[N] **Radiofrequency electromagnetic fields have no effect on the in vivo proliferation of the 9L brain tumor** VIEW
Higashikubo R, Culbreth VO, Spitz DR, LaRegina MC, Pickard WF, Straube WL, Moros EG, Roti Roti JL,
Radiat Res 152(6):665-671, 1999

[N] **Radiofrequency Radiation on the Induction or Promotion of Brain Tumors and Other Neoplasms in Rats.** VIEW
Zook BC, Simmens SJ,
Radiat Res 155(4):572-583, 2001

[N] **Short term exposure to 1439 MHz pulsed TDMA field does not alter melatonin synthesis in rats.** VIEW
Hata K, Yamaguchi H, Tsurita G, Watanabe S, Wake K, Taki M, Ueno S, Nagawa H.
Bioelectromagnetics. 26(1):49-53, 2005

[N] **Spontaneous and nitrosourea-induced primary tumors of the CNS in rats exposed to FM microwave fields.** VIEW
Adey WR, Byus CV, Cain CD, Higgins RJ, Jones RA, Kean CJ, Kuster N, MacMurray A, Stagg RB, Zimmerman G,
Cancer Res 60(7):1857-1863, 2000

[N] **Stress response in tube restrained Fisher 344 rats exposed or sham exposed to digitally modulated cellphone microwave fields.** VIEW

Stagg RB, Jones RA, Byus CV, Adey WR
Presented at the BEMS conference in Long Beach, California 1999

[N] **Studies on microwave and blood-brain barrier interaction.** VIEW
Lin JC, Lin MF
Bioelectromagnetics. 1(3):313-23, 1980

[N] **The 1.5 GHz electromagnetic near-field used for cellular phones does not promote rat liver carcinogenesis in a medium-term liver bioassay.** VIEW
Imaida K, Taki M, Watanabe S, Wake K, Kamimura Y, Ito T, Yamaguchi T, Ito N, Shirai T
Jpn J Cancer Res 89(10):995-1002, 1998

[N] **The Effect of Chronic Exposure to 835.62 MHz FDMA or 847.74 MHz CDMA RFR on the Incidence of Spontaneous Tumors in Rats** VIEW
La Regina M, Moros EG, Pickard WF, Straube WL, Baty J, Roti Roti JL
Radiat Res. 160(2):143-151, 2003

[N] **The effect of low-intensity prolonged impulse electromagnetic irradiation in the UHF range on the testes and the appendages of the testis in rats** VIEW
Lokhmatova SA
Radiats Biol Radioecol 34(2):279-285, 1994

[N] **The effects of 3000 MHz microwave irradiation on electroencephalic energy and energy metabolism in mouse brains** VIEW
Pu JS, Chen J, Yang YH, Bai YQ
Electro-and Magnetobiology 16:243-247, 1997

[N] **The ocular effects of microwaves on hypothermic rabbits: a study of microwave cataractogenic mechanisms** VIEW
Kramar PO, Emery AF, Guy AW, Lin JC
Ann NY Acad Sci. 1975 Feb 28;247:155-65, 1975

[N] **Ultra-wideband electromagnetic pulses and morphine-induced changes in nociception and activity in mice.** VIEW
Seaman RL, Belt ML, Doyle JM, Mathur SP
Physiol Behav 65(2):263-270, 1998

[N] **Ultra-wideband electromagnetic pulses: lack of effects on heart rate and blood pressure during two-minute exposures of rats.** VIEW
Jauchem JR, Seaman RL, Lehnert HM, Mathur SP, Ryan KL, Frei MR, Hurt WD
Bioelectromagnetics 19(5): 330-333, 1998

[N] **Whole body exposure of rats to microwaves emitted from a cell phone does not affect the testes.** VIEW
Dasdag S, Zulkuf Akdag M, Aksen F, Yilmaz F, Bashan M, Mutlu Dasdag M, Salih, Celik M
Bioelectromagnetics 24(3):182-188, 2003

[N] **Whole-body exposure to 2.45 GHz electromagnetic fields does not alter anxiety responses in rats** VIEW
Cosquer B, Galani R, Kuster N, Cassel JC.
Behav Brain Res. 156(1):65-74, 2005

[N] **Whole-body exposure to 2.45 GHz electromagnetic fields does not alter radial-maze performance in rats.** VIEW
Cassel JC, Cosquer B, Galani R, Kuster N.
Behav Brain Res. 155(1):37-43, 2004

[N] **Whole-body exposure to 2.45GHz electromagnetic fields does not alter 12-arm radial-maze with reduced access to spatial cues in rats.** VIEW
Cosquer B, Kuster N, Cassel JC.
Behav Brain Res. 161(2):331-334, 2005

[NA] **A catheter antenna for percutaneous microwave therapy** VIEW
Lin JC, Wang YJ,
Microwave & Optical Technology Letters. 8(2):70-72, 1995

[NA] **Catheter microwave ablation therapy for cardiac arrhythmias** VIEW
Lin JC
Bioelectromagnetics. (Suppl 4):120-132, 1999

[NA] **In-vivo testing of digital cellular telephones in patients with implantable cardioverter-defibrillators** VIEW
Chiladakis JA, Davlouros P, Agelopoulos G, Manolis AS.
Eur Heart J 22(15):1337-1342, 2001

[NA] **Iodine compounds and superhigh-frequency EMF on the excitability and accommodative capacity of nervous and muscular tissues in frogs** VIEW
Tereshin S,
Vopr Kurortol Fizioter Lech Fiz Kult (5):31-33, 1999

[NA] **Oxidative stress precedes circulatory failure induced by 35-GHz microwave heating.** VIEW
Kalns J, Ryan KL, Mason PA, Bruno JG, Gooden R, Kiel JL,
Shock 13(1):52-59, 2000

[NA] **The cap-choke catheter antenna for microwave ablation treatment** VIEW
Lin JC, Wang YJ,
IEEE Transactions on Biomedical Engineering. 43(6):657-660, 1996

[NA] **The effect of pulsed EMF on the EEG of humans.** VIEW
von Klitzing L
CETECOM Edition Wissenschaft Nr.9 1996

[Y] **0^6-methylguanini E-DNA-methyltransgerase activity and ODC activity in brains.** VIEW
Cain CD, Ghaffari M, Jones RA, Archambeau J, Adey WR,
Presented at BEMS in St Petersburg, Florida 1998

[Y] **60 Hz magnetic field exposure induces DNA crosslinks in rat brain cells.** VIEW
Singh NP, Lai H,
Mutat-Res. 1998 May 25. 400(1-2). P 313-20 1998

[Y] **60 Hz Magnetic fields and Central Cholinergic Activity: Effects of Exposure Intensity and Duration.** VIEW
Lai H, Carino MA
Bioelectromagnetics (In press) 1998 **NOTE: 50/60 Hz study**

[Y] **A novel antioxidant agent caffeic acid phenethyl ester prevents long-term mobile phone exposure-induced renal impairment in rat.** VIEW
Ozguner F, Oktem F, Ayata A, Koyu A, Yilmaz HR.
Mol Cell Biochem. 277(1-2):73-80, 2005

[Y] **A small temperature rise may contribute towards the apparent induction by microwaves of heat-shock gene expression in the nematode Caenorhabditis Elegans.** VIEW
Dawe AS, Smith B, Thomas DW, Greedy S, Vasic N, Gregory A, Loader B, de Pomerai DI.
Bioelectromagnetics. Dec 8; 2005

[Y] **Absence of chronic effect of exposure to short-wave radio broadcast signal on salivary melatonin concentrations in dairy cattle** VIEW
Stark KD, Krebs T, Altpeter E, Manz B, Griot C, Abelin T,
J Pineal Res 22(4):171-176, 1997

[Y] **Acute effects of pulsed microwaves and 3-nitropropionic acid on neuronal ultrastructure in the rat caudate-putamen.** VIEW
Seaman RL, Phelix CF.
Bioelectromagnetics. 26(2):82-101, 2005

[Y] **Acute exposure to a 60 Hz magnetic field increases DNA strand breaks in rat brain cells.** VIEW
Lai H, Singh NP
Bioelectromagnetics. 18(2). P 156-65. 1997

[Y] **Acute exposure to pulsed 2450-MHz microwaves affects water maze learning in the rat.** VIEW
Wang BM, Lai H
Bioelectromagnetics 21:52-56, 2000

[Y] **Acute Exposure to Pulsed 2450-MHz Microwaves Affects Water-Maze Performance of Rats** VIEW
Wang B, Lai H
Bioelectromagnetics (In press) 1998

[Y] **Acute low-intensity microwave exposure increases DNA single- strand breaks in rat brain cells.** VIEW
Lai H, Singh NP
Bioelectromagnetics. 16(3). P 207-10. 1995

[Y] **Adrenergic nerve plexuses of heart and adrenal and myocardial catecholamines of spontaneously hypertensive rats under the influence of EMR in the millimeter range** VIEW
Belousova TE, Kargina-Terent'eva RA,
Morfologiia 115(1):16-18, 1999

[Y] **Alteration of life span of mice chronically exposed to 2.45 GHz CW microwaves.** VIEW
Liddle CG, Putnam JP, Huey OP,
Bioelectromagnetics 15(3):177-181, 1994

[Y] **Animal study on electromagnetic field biological potency** VIEW
Trosic I, Matausicpisl M, Radalj Z, Prlic I
Arh Hig Rada Toksikol 50(1):5-11, 1999

[Y] **Animal study on electromagnetic field biological potency** VIEW
Trosic I, Matausicpisl M, Radalj Z, Prlic I,
Arh Hig Rada Toksikol 50(1):5-11, 1999

[Y] **Antibody responses of mice exposed to low-power microwaves under combined, pulse-and-amplitude modulation** VIEW
Veyret B, Bouthet C, Deschaux P, de Seze R, Geffard M, Joussot-Dubien J, le Diraison M, Moreau JM, Caristan A,
Bioelectromagnetics 12(1):47-56, 1991

[Y] **Assessment of radio-frequency electromagnetic radiation by the micronucleus test in bovine peripheral erythrocytes.** VIEW
Balode Z
Sci Total Environ 180(1):81-85, 1996

[Y] **Athermal alterations in the structure of the canalicular membrane and ATPase activity induced by thermal levels of microwave radiation.** VIEW
Phelan AM, Neubauer CF, Timm R, Neirenberg J, Lange DG,
Radiat Res 137(1):52-58, 1994

[Y] **Biological and morphological effects on the reproductive organ of rats after exposure to electromagnetic field.** VIEW
Ozguner M, Koyu A, Cesur G, Ural M, Ozguner F, Gokcimen A, Delibas N.
Saudi Med J. 26(3):405-410, 2005

[Y] **Biological and morphological effects on the reproductive organ of rats after exposure to electromagnetic field.** VIEW
Ozguner M, Koyu A, Cesur G, Ural M, Ozguner F, Gokcimen A, Delibas N.
Saudi Med J. 26(3):405-410, 2005

[Y] **Blood-brain barrier permeability in rats exposed to electromagnetic fields used in wireless communication.** VIEW
Persson BRR, Salford LG, Brun A
Wireless Network 3:455-461, 1997

[Y] **Blood-forming system in rats after whole-body microwave exposure; reference to the lymphocytes** VIEW
Trosic I, Busljeta I, Pavicic I.
Toxicol Lett.154(1-2):125-132, 2004

[Y] **Cardiovascular and thermal effects of microwave irradiation at 1 and/or 10 GHz in anesthetized rats.** VIEW
Jauchem JR, Ryan KL, Freidagger MR
Bioelectromagnetics 21(3):159-66, 2000

[Y] **Cerebrovascular permeability to 86Rb in the rat after exposure to pulsed microwaves** VIEW
Goldman H, Lin JC, Murphy S, Lin MF
Bioelectromagnetics. 1984;5(3):323-30. 1984

[Y] **Change in the percent of lactate dehydrogenase isoenzyme level in testes of animals exposed to superhigh frequency radiation** VIEW
Afromeev VI, Tkachenko VN,
Biofizika 44(5):931-932, 1999

[Y] **Changes in drug pharmacokinetics and pharmacodynamics under the influence of microwaves of different ranges** VIEW
Ulashchik VS
Vopr Kurortol Fizioter Lech Fiz Kult 4):1-6, 1993

[Y] **Changes in gap junctional intercellular communication in rabbits lens epithelial cells induced by low power density microwave radiation.** VIEW
Ye J, Yao K, Zeng Q, Lu D
hin Med J (Engl) 115(12):1873-1876, 2002

[Y] **Changes in serum alkaline phosphatase activity during in vitro exposure to AM EMF of ultrahigh frequency (2375 MHz) in guinea pigs** VIEW
Pashovkina MS, Akoev IG
Biofizika 45(1):130-136, 2000

[Y] **Changes of neurocytes in CNS under general exposure to UHF field** VIEW
Leshin VV,
Med Tr Prom Ekol (5):5-8, 2000

[Y] **Changes of nitric oxide synthase in hippocampus and cerebellum of the rat following exposure to electromagnetic pulse.** VIEW
Ding G, Xie X, Zhang L,
Chin J Phys Med 20:81-83, 1998

[Y] **Changes of nitric oxide synthase in hippocampus and cerebellum of the rat following exposure to electromagnetic pulses** VIEW
Ding GR, Xie XJ, Zhang ZX, Zhou Y, Guo Y
Chin J Phys Med 20: 81-83, 1998

[Y] **Comparative analysis of the protective effects of melatonin and caffeic acid phenethyl ester (CAPE) on mobile phone-induced renal impairment in rat** VIEW
Ozguner F, Oktem F, Armagan A, Yilmaz R, Koyu A, Demirel R, Vural H, Uz E.
Mol Cell Biochem. 276(1-2):31-37, 2005

[Y] **Corticotropin-releasing factor antagonist blocks microwave- induced decreases in high-affinity choline uptake in the rat brain.** VIEW
Lai H, Carino MA, Horita A, Guy AW
Brain-Res-Bull. 1990 Oct. 25(4). P 609-12. 1990

[Y] **Differential response of the permeability of the rat liver canalicular membrane to sucrose and mannitol.** VIEW
Lange DG, D'Antuono ME, Timm RR, Ishii TK, Fujimoto JM,
Radiat Res 134(1):54-62, 1993

[Y] **Digital cellphone field exposures, *in utero*, alter ODC and polyamine levels in fetal rat brains.** VIEW
Cain CD, Ghaffari M, Jones RA, Byus CV, Adey WR,
Presented at BEMS in Long Beach California, 1999

[Y] **Disruption of a putative working memory task and selective expression of brain c-fos following microwave-induced hyperthermia** VIEW
Mickley GA, Cobb BL, Mason PA, Farrell S,
Physiol Behav 55(6):1029-1038, 1994

[Y] **DNA synthesis and cell proliferation in C6 glioma and primary glial cells exposed to a 836.55 MHz modulated radiofrequency field.** VIEW
Stagg RB, Thomas WJ, Jones RA, Adey WR
Bioelectromagnetics 18(3):230-236, 1997

[Y] **Effect of amplitude modulated RF radiation on calcium ion efflux and ODC activity in chronically exposed rat brain** VIEW
Paulraj R, Behari J, Rao AR,
Indian J Biochem Biophys 36(5):337-340, 1999

[Y] **Effect of amplitude-modulated radio frequency radiation on cholinergic system of developing rats.** VIEW
Kunjilwar KK, Behari J
Brain Res 601(1-2):321-324, 1993

[Y] **Effect of centimeter microwaves and the combined magnetic field on the tumor necrosis factor production in cells of mice with experimental tumors** VIEW
Novoselova EG, Ogai VB, Sorokina OV, Novikov VV, Fesenko EE.,
Biofizika 46(1):131-135, 2001

[Y] **Effect of exposure to 900 MHz radiofrequency radiation on intrachromosomal recombination in pKZ1 mice.** VIEW
Sykes PJ, McCallum BD, Bangay MJ, Hooker AM, Morley AA
Enzyme Microbial Tech 30:73-79, 2002

[Y] **Effect of Exposure to 900 MHz Radiofrequency Radiation on Intrachromosomal Recombination in pKZ1 Mice.** VIEW
Sykes PJ, McCallum BD, Bangay MJ, Hooker AM, Morley AA
Radiat Res 156(5):495-502, 2001

[Y] **Effect of extremely high frequency electromagnetic radiation of low intensity on parameters of humoral immunity in healthy mice.** VIEW
Lushnikov KV, Gapeev AB, Sadovnikov VB, Cheremis NK
Biofizika 46(4):753-760, 2001

[Y] **Effect of extremely high-frequency electromagnetic radiation on the function of skin sensory endings** VIEW
Enin LD, Akoev GN, Potekhina IL, Oleiner VD,
Patol Fiziol Eksp Ter Sep-Dec;(5-6):23-25, 1992

[Y] **Effect of global system for mobile communication (GSM) microwave exposure on BBB permeability in rat.** VIEW
Fritze K, Sommer C, Schmitz B, Mies G, Hossmann KA, Kiessling M, Wiessner C,
Acta Neuropathol (Berl) 94(5):465-470, 1997

[Y] **Effect of global system for mobile communication (gsm)-like radiofrequency fields on vascular permeability in mouse brain.** VIEW
Finnie JW, Blumbergs PC, Manavis J, Utteridge TD, Gebski V, Swift JG, Vernon-Roberts B, Kuchel TR
Pathology 33(3):338-340, 2001

[Y] **Effect of global system for mobile communication microwave exposure on the genomic response of the rat brain.** VIEW
Fritze K, Wiessner C, Kuster N, Sommer C, Gass P, Hermann DM, Kiessling M, Hossmann KA,
Neuroscience 81(3):627-639, 1997

[Y] **Effect of GSM microwave exposure on blood-brain barrier permeability in rat** VIEW
Fritze K, Sommer C, Schmitz B, Mies G, Klessing M, Hossmann KA, Weissner C,
Acta Neuropathologica 94: 465-470 1997

[Y] **Effect of GSM microwave exposure on the genomic response of the rat brain.** VIEW
Fritze K, Wiessner C, Kuster N, Sommer C, Gass P, Hermann DM, Klessing M, Hossmann KA,
Neuroscience 81: 627-639 1997

[Y] **Effect of low-energy and high-peak-power nanosecond pulses of microwave radiation on malignant tumors** VIEW
Devyatkov ND, Pletnyov SD, Betskii OV, Faikin VV,
Crit Rev Biomed Eng 29(1):98-110, 2001

[Y] **Effect of low-intensity millimeter wave electromagnetic radiation on regeneration of the sciatic nerve in rats.** VIEW
Kolosova LI, Akoev GN, Avelev VD, Riabchikova OV, Babu KS,
Bioelectromagnetics 17(1):44-47, 1996

[Y] **Effect on the immune system of mice exposed chronically to 50 Hz amplitude-modulated 2.45 GHz microwaves.** VIEW
Elekes E, Thuroczy G, Szabo LD
Bioelectromagnetics 17(3):246-248, 1996

[Y] **Effects of 1.6 GHz microwaves (CW and pulsed wave) on c-fos, EGFR and NSCL-1 gene expression in the mouse brain.** VIEW
Morrissey JJ, Raney S, Heasley E, Rathinavelu P, Dauphinee M, Fallon JH,
Proceedings of the 1997 World Congress on Electricity and Magnetism in Biology and Medicine 1997

[Y] **Effects of 900MHz electromagnetic field on TSH and thyroid hormones in rats** VIEW
Koyu A, Cesur G, Ozguner F, Akdogan M, Mollaoglu H, Ozen S.
Toxicol Lett. 157(3):257-262, 2005

[Y] **Effects of acute low-level microwaves on pentobarbital-induced hypothermia depend on exposure orientation.** VIEW
Lai H, Horita A, Chou CK, Guy AW
Bioelectromagnetics. 5(2). P 203-11. 1984

[Y] **Effects of exposure to low level radiofrequency fields on acetylcholine release in hippocampus of freely moving rats** VIEW
Testylier G , Tonduli L, Malabiau R, Debouzy JC.
Bioelectromagnetics 23:249-255, 2002

[Y] **Effects of GSM 900 MHz Mobile Phone Radiation on the Reproductive Capacity of Drosophila melanogaster** VIEW
Panagopoulos DJ, Karabarbounis A, Margaritis LH.
Electromag. Biol. Med. 23:29-43, 2004

[Y] **Effects of GSM-900 Microwaves on DMBA-Induced Mammary Gland Tumors in Female Sprague-Dawley Rats** VIEW
Anane R, Dulou P-E, Taxile M, Geffard M, Crespeau F, Veyret B
Radiat Res 160:492497, 2003

[Y] **Effects of high peak power microwaves on the retina of the rhesus monkey.** VIEW
Lu ST, Mathur SP, Stuck B, Zwick H, D'Andrea JA, Ziriax JM, Merritt JH, Lutty G, McLeod DS, Johnson M,
Bioelectromagnetics 21(6):439-454, 2000

[Y] **Effects of low level 2.45 GHz microwave radiation on Ca2+ efflux and ODC activity in chronically exposed developing rat brain.** VIEW
Paul Raj R, Behari J. Rao AR
Presented at the National Seminar on Low-level Electromagnetic Field Phenomena in Biological Systems. New Delhi, India, February, 1999

[Y] **Effects of low level pulsed radio frequency fields on induced osteoporosis in rat bone** VIEW
Jayanand, Behari J, Lochan R.
Indian J Exp Biol. 41(6):581-586, 2003

[Y] **Effects of low-intensity electromagnetic fields on behavioral activity of rats.** VIEW
Kemerov S, Marinkev M, Getova D
Folia Med (Plovdiv) 41(3):75-80, 1999

[Y] **Effects of low-level microwave irradiation on amphetamine hyperthermia are blockable by naloxone and classically conditionable.** VIEW
Lai H, Horita A, Chou CK, Guy AW
Psychopharmacology-Berl. 1986. 88(3). P 354-61. 1986

[Y] **Effects of low-level microwave irradiation on hippocampal and frontal cortical choline uptake are classically conditionable.** VIEW
Lai H, Horita A, Chou CK, Guy AW
Pharmacol-Biochem-Behav. 1987 Aug. 27(4). P 635-9. 1987

[Y] **Effects of microwave exposure at various power densities on mitochondrial enzymes in mouse brain.** VIEW
Chiang H, Yao GD, Zhou SY
J Bioelectricity 3:361-366, 1984

[Y] **Effects of microwave radiation and strychnine on cerebral biopotentials in narcotized rats.** VIEW
Sidorenko A, Tsaryuk V,
Bull Exp Biol Med 130(9):835-837, 2000

[Y] **Effects of mobile phone radiation on reproduction and development in Drosophila melanogaster.** VIEW
Weisbrot D, Lin H, Ye L, Blank M, Goodman R
J Cell Biochem 89(1):48-55, 2003

[Y] **Effects of mobile phone radiation on UV-induced skin tumourigenesis in ornithine decarboxylase transgenic and non-transgenic mice.** VIEW
Heikkinen P, Kosma VM, Alhonen L, Huuskonen H, Komulainen H, Kumlin T, Laitinen JT, Lang S, Puranen L, Juutilainen J
Int J Radiat Biol 79(4):221-233, 2003

[Y] **Effects of pre-and post-natal pulse microwave irradiation on developing mice** VIEW
Chiang H, Wang XH, Yao GD, Cheng GZ, Yang QE, Zhou SY, Lou Y
Chen J Bio Med Engineering 7:63-68, 1988

[Y] **Effects of Pulse Microwave Exposure on Mitochondrial Marker Enzyme and Energy Metabolism in Mouse Brain (1)** VIEW
Chiang H
Paper presented at Erice, Sicily, Italy, November 21-25, 1999

[Y] **Effects of pulse microwave radiation pre-and post-natally on developing mice (2)** VIEW
Chaing H,
Paper presented at Erice, Sicily, Italy, November 21-25, 1999

[Y] **Effects of radiofrequency exposure on the GABAergic system in the rat cerebellum: clues from semi-quantitative immunohistochemistry** VIEW
Mausset A, de Seze R, Montpeyroux F, Privat A
Brain Res 912(1):33-46, 2001

[Y] **Effects of stress-inducing microwave radiation on life-cycle parameters in the nematode Caenorrabditis elegans** VIEW
De Pomerai DI, Daniells C, Barker SL, Scott S, Duce IR, Thomas DW, Sewell PD, Tattersall JEH
Presented at the Twentieth Annual Meeting of the Bioelectromagnetics Society, St. Pete Beach, FL, June 1999

[Y] **Effects of weak microwave fields amplitude modulated at ELF on EEG of symmetric brain areas in rats.** VIEW
Vorobyov VV, Galchenko AA, Kukushkin NI, Akoev IG
Bioelectromagnetics 18(4):293-298, 1997

[Y] **Electromagnetic fields at mobile phone frequency induce apoptosis and inactivation of the multi-chaperone complex in human epidermoid cancer cells.** VIEW
Caraglia M, Marra M, Mancinelli F, D'ambrosio G, Massa R, Giordano A, Budillon A, Abbruzzese A, Bismuto E.
J Cell Physiol. Mar 7 2005

[Y] **Electromagnetic millimeter waves increase the duration of anaesthesia caused by ketamine and chloral hydrate in mice.** VIEW
Rojavin MA, Ziskin MC
Int J Radiat Biol 72(4):475-480, 1997

[Y] **Enhancement of anticancer drug delivery to the brain by microwave induced hyperthermia** VIEW
Lin JC, Yuan PMK, Jung DT
Bioelectrochemistry & Bioenergetics. 47(2):259-264, 1998

[Y] **Erythropoietic changes in rats after 2.45 GJz nonthermal irradiation** VIEW
Busljeta I, Trosic I, Milkovic-Kraus S.
Int J Hyg Environ Health. 207(6):549-554, 2004

[Y] **Erythropoietic dynamic equilibrium in rats maintained after microwave irradiation** VIEW
Trosic I, Busljeta I.
Exp Toxicol Pathol. 57(3):247-251, 2006

[Y] **Ethanol-induced hypothermia and ethanol consumption in the rat are affected by low-level microwave irradiation.** VIEW
Lai H, Horita A, Chou CK, Guy AW
Bioelectromagnetics. 1984. 5(2). P 213-20. 1984

[Y] **Evaluation of bone density in rats after hydrocortisone and microwaveradiation** VIEW
Olchowik G
Chir Narzadow Ruchu Ortop Pol 62(2):163-167, 1999

[Y] **Evaluation of potential genotoxocity of RF fields *In Vivo*, using the single cell gell (SCG) electrophoresis assay.** VIEW
Tice RR, Vasquez M, McDougal J, Chou CK, Hook GJ, McRee D
Prsented at the WTR Seccond State of the Science Colloquium in Long Beach California 1999

[Y] **Experimental study of the effects of radiofrequency electromagnetic fields on animals with soft tissue wounds.** VIEW
Detlavs I, Dombrovska L, Turauska A, Shkirmante B, Slutskii L
Sci Total Environ 180(1):35-42, 1996

[Y] **Exposure of djungarian hamsters to 383 MHz (TETRA 25 standard) and 900 MHz (GSM standard) EMF.** VIEW
Lerchl A
Presented at BEMS in Long Beach California, 1999

[Y] **Exposure of human peripheral blood lymphocytes to electromagnetic fields associated with cellular phones leads to chromosomal instability.** VIEW
Mashevich M, Folkman D, Kesar A, Barbul A, Korenstein R, Jerby E, Avivi L
Bioelectromagnetics 24:82-90, 2003

[Y] **Extraordinary behavior disorders in cows in proximity to transmission stations.** VIEW
Loscher W, Kas G
Der Praktische Tierarz 79:437-444, 1998

[Y] **Forming of memory (imprinting) in chicks after prior low-level exposure to electromagnetic fields]** VIEW
Grigor'ev IuG, Stepanov VS
Radiats Biol Radioecol 38(2):223-231, 1998

[Y] **Frequency of micronuclei in the peripheral blood and bone marrow of cancer-prone mice chronically exposed to 2450 MHz radiofrequency radiation.** VIEW
Vijayalaxmi, Frei MR, Dusch SJ, Gue V, Melt ML, Jauchem JR
Radiat Res 147(4):495-500, 1997

[Y] **Hematopoietic neoplasia in C57BL/6 mice exposed to split-dose ionizing radiation and circularly polarized 60 Hz magnetic fields.** VIEW
Babbitt JT, Kharazi AI, Taylor JM, Bonds CB, Mirell SG, Frumkin E, Zhuang D, Hahn TJ
Carcinogenesis 2000 Jul;21(7):1379-89 2000 **NOTE: 50/60 Hz study**

[Y] **Hyperactivity caused by a nitric oxide synthase inhibitor is countered by ultra-wideband pulses.** VIEW
Seaman RL, Belt ML, Doyle JM, Mathur SP
Bioelectromagnetics 20(7):431-439, 1999

[Y] **Ibuprofen effects on behavioral thermoregulation with microwave radiation in albino rats.** VIEW
Vitulli WF, Nemeth YM, Conte CT,
Percept Mot Skills 92(2):391-394, 2001

[Y] **Impact of radio frequency electromagnetic radiation on DNA integrity in the male germline** VIEW
Aitken RJ, Bennetts LE, Sawyer D, Wiklendt AM, King BV.
International Journal of Andrology OnlineEarly doi:10.1111/j.1365-2605.2005.00531.x -- 2005

[Y] **Increased sensitivity of the non-human primate eye to microwave radiation following ophthalmic drug pretreatment** VIEW
Kues HA, Monahan JC, D'Anna SA, McLeod DS, Lutty GA, Koslov S,
Bioelectromagnetics 13(5):379-393, 1992

[Y] **Influence of anesthesia on ocular effects and temperature in rabbit eyes exposed to microwaves.** VIEW
Kojima M, Hata I, Wake K, Watanabe S, Yamanaka Y, Kamimura Y, Taki M, Sasaki K.
Bioelectromagnetics 25(3):228-233, 2004

[Y] **Influence of EMP on the nervous system of rats.** VIEW
Wu Y, Jia Y, Guo Y, Zheng Z
ACTA Biophysica Sinica 15:152-157, 1999

[Y] **Influence of hydrocortisone and microwave radiation on the mechanical characteristics of rat bone tissue.** VIEW
Olchowik G.
Cytobios 105(410):147-152, 2001

[Y] **Influence of microwave exposure on chlordiazepoxide effects in the mouse staircase test.** VIEW
Quock RM, Klauenberg BJ, Hurt WD, Merritt JH
Pharmacol Biochem Behav 47(4):845-849, 1994

[Y] **Influence of microwave exposure on chlordiazepoxide effects in the mouse staircase test.** VIEW
Quock RM, Klauenberg BJ, Hurt WD, Merritt JH
Pharmacol Biochem Behav 47(4):845-849, 1994

[Y] **Inhibitory action of microwave radiation on gamma-glutamyl transpeptidase activity in liver of rats treated with hydrocortisone.** VIEW
Olchowik G, Maj JG,
Folia Histochem Cytobiol 38(4):189-191, 2000

[Y] **Inhibitory effects of melatonin on preneoplastic liver lesions in in F344 rats: relation to the influence of EM near field exposure.** VIEW
Imaida K, Hagiwara A, Yoshino H, Tamano S, Sano M, Futakuchi M, Ogawa K, Asamoto M, Shirai T,
Cancer Lett 155(1):105-114, 2000

[Y] **Interaction of ethanol and microwaves on the blood-brain barrier of rats** VIEW
Neilly JP, Lin JC
Bioelectromagnetics. 1986;7(4):405-14 1986

[Y] **Interaction of low level modulated RF radiation with Na^+ K^+-ATPase** VIEW
Behari J, Kunjilwar KK, and Pyne S
Bioelectrochem Bioenerg 47:247-252, 1998

[Y] **Interaction of Microwaves and a Temporally Incoherent Magnetic Field on Single and Double DNA Strand Breaks in Rat Brain Cells** VIEW
Lai H, Singh NP
Electromag Biol Med 24:23-29, 2005

[Y] **Interaction of microwaves and a temporally incoherent magnetic field on spatial learning in the rat.** VIEW
Lai H.
Physiol Behav. 82(5):785-789, 2004

[Y] **Intracerebroventricular injection of mu- and delta-opiate receptor antagonists block 60 Hz magnetic field-induced decreases in cholinergic activity in the frontal cortex and hippocampus of the rat.** VIEW
Lai H, Carino MA
Bioelectromagnetics. 1998. 19(7). P 432-7. 1998 **NOTE: 50/60 Hz study**

[Y] **Intraseptal microinjection of beta-funaltrexamine blocked a microwave-induced decrease of hippocampal cholinergic activity in the rat** VIEW
Lai H, Carino MA, Horita A, Guy AW,
Pharmacol Biochem Behav 53(3):613-616, 1994

[Y] **Iridium exposure increase *c-fos* expression in the mouse brain.** VIEW
Morrissey JJ, Rauey S, Heasley E, Rathinavelua P, Dauphinee M, Fallon JH
Neuroscience 92:1539:1546 1999

[Y] **Low power density microwave radiation induced early changes in rabbit lens epithelial cells.** VIEW
Ye J, Yao K, Lu D, Wu R, Jiang H
Chin Med J (Engl) 114(12):1290-1294, 2001

[Y] **Low-level microwave irradiation and central cholinergic activity: a dose-response study.** VIEW
Lai H, Carino MA, Horita A, Guy AW
Bioelectromagnetics. 1989. 10(2). P 203-8. 1989

[Y] **Low-level microwave irradiation and central cholinergic systems.** VIEW
Lai H, Carino MA, Horita A, Guy AW
Pharmacol-Biochem-Behav. 1989 May. 33(1). P 131-8. 1989

[Y] **Low-level microwave irradiation attenuates naloxone-induced withdrawal syndrome in morphine-dependent rats** VIEW
Lai H, Horita A, Chou CK, Guy AW,
Pharmacol-Biochem-Behav. Jan. 24(1). P 151-3. 1986

[Y] **Low-level microwave irradiations affect central cholinergic activity in the rat.** VIEW
Lai H, Horita A, Chou CK, Guy AW
J-Neurochem. 1987 Jan. 48(1). P 40-5. 1987

[Y] **Lymphomas in E mu-Pim1 transgenic mice exposed to pulsed 900 MHZ electromagnetic fields.** VIEW
Repacholi MH, Basten A, Gebski V, Noonan D, Finnie J, Harris AW
Radiat Res 147(5):631-640, 1997

[Y] **Melatonin and a spin-trap compound block radiofrequency electromagnetic radiation-induced DNA strand breaks in rat brain cells.** VIEW
Lai H, Singh NP
Bioelectromagnetics 18(6):446-454, 1997

[Y] **Melatonin and N-tert-butyl-alpha-phenylnitrone block 60-Hz magnetic field-induced DNA single and double strand breaks in rat brain cells.** VIEW
Lai H, Singh NP
J-Pineal-Res. 1997 Apr. 22(3). P 152-62. 1997

[Y] **Micronucleus induction after whole-body microwave irradiation of rats** VIEW
Trosic I, Busljeta I, Kasuba V, Rozgaj R
Mutat Res 521(1-2):73-79, 2002

[Y] **Microwave irradiation affects radial-arm maze performance in the rat** VIEW
Lai H, Horita A, Guy AW,
Bioelectromagnetics 15(2):95-104, 1994

[Y] **Microwave irradiation affects radial-arm maze performance in the rat.** VIEW
Lai H, Horita A, Guy AW
Bioelectromagnetics. 1994. 15(2). P 95-104. 1994

[Y] **Microwave irradiation of rats at 2.45 GHz activates pinocytotic-like uptake of tracer by capillary endothelial cells of cerebral cortex.** VIEW

Neubauer C, Phelan AM, Kues H, Lange DG,
Bioelectromagnetics 11(4):261-268, 1990

[Y] **Microwave-evoked brainstem potentials in cats** VIEW
Lin JC, Meltzer RJ, Redding FK
J Microwave Power. 1979 Sep;14(3):291-6 1979

[Y] **Microwave-induced thermoelastic pressure wave propagation in the cat brain.** VIEW
Lin JC, Su JL, Wang Y
Bioelectromagnetics. 1988;9(2):141-7 1988

[Y] **Microwaves and cellular immunity. I. Effect of whole body microwave irradiation on tumor necrosis factor production in mouse cells.** VIEW
Fesenko EE, Makar VR, Novoselova EG, Sadovnikov VB,
Bioelectrochem Bioenerg 49(1):29-35, 1999

[Y] **Microwaves and cellular immunity. II. Immunostimulating effects of microwaves and naturally occurring antioxidant nutrients.** VIEW
Novoselova EG, Fesenko EE, Makar VR, Sadovnikov VB
Bioelectrochem Bioenerg;49(1):37-41, 1999

[Y] **Microwave-specific heating affects gene expression.** VIEW
Saffer JD, Profenno LA,
Bioelectromagnetics 13(1):75-78, 1992

[Y] **Millimeter wave-induced suppression of B16 F10 melanoma growth in mice: involvement of endogenous opioids.** VIEW
Radzievsky AA, Gordiienko OV, Szabo I, Alekseev SI, Ziskin MC
Bioelectromagnetics. 25(6):466-473, 2004

[Y] **Mobile phone-induced myocardial oxidative stress:** VIEW
Ozguner F, Altinbas A, Ozaydin M, Dogan A, Vural H, Kisioglu AN, Cesur G, Yildirim NG.
Toxicol Ind Health. 21(9):223-230, 2005

[Y] **Modification of lethal radiation injury in mice by postradiation exposure to low-intensity centimeter-band radio frequency waves** VIEW
Akoev IG, Mel'nikov VM, Usachev AV, Kozhokaru AF,
Radiats Biol Radioecol 34(4-5):671-674, 1994

[Y] **Mortality of chicken embryos exposed to EMFs from mobile phones.** VIEW
Youbicier-Simo BJ, Lebecq JC, Bastide M
Presented at the Twentieth Annual Meeting of the Bioelectromagnetics Society, St. Pete Beach, FL, June 1998

[Y] **Motor activity of rabbits in conditions of chronic low-intensity pulse microwave irradiation** VIEW
Grigor'ev IuG, Luk'ianova SN, Makarov VP, Rynskov VV, Moiseeva NV
Radiats Biol Radioecol 35(1):29-35, 1995

[Y] **Multinucleated giant cell appearance after whole body microwave irradiation of rats.** VIEW
Trosic I
Int J Hyg Environ Health. 204(2-3):133-138, 2001

[Y] **Naltrexone blocks RFR-induced DNA double strand breaks in rat brain cells.** VIEW
Lai H, Carino MA, Singh NP
Wireless Networks 3:471-476, 1997

[Y] **Naltrexone pretreatment blocks microwave-induced changes in central cholinergic receptors.** VIEW
Lai H, Carino MA, Wen YF, Horita A, Guy AW,
Bioelectromagnetics 12(1):27-33, 1991

[Y] **Naltrexone pretreatment blocks microwave-induced changes in central cholinergic receptors.** VIEW
Lai H, Carino MA, Wen YF, Horita A, Guy AW
Bioelectromagnetics. 1991. 12(1). P 27-33. 1991

[Y] **Nitric oxide level in the nasal and sinus mucosa after exposure to electromagnetic field** VIEW
Yariktas M, Doner F, Ozguner F, Gokalp O, Dogru H, Delibas N
Otolaryngol Head Neck Surg. 132(5):713-716, 2005

[Y] **Non-thermal heat-shock response to microwaves,** VIEW
de Pomerai D, Daniells C, David H, Allan J, Duce I, Mutwakil M, Thomas D, Sewell P, Tattersall J, Jones D, Candido P
Nature May 25, 2000

[Y] **On the mechanism of cytogenetic effect of electromagnetic radiation: a role of oxidation homeostasis** VIEW
Brezitskaia HV, Timchenko OI,
Radiats Biol Radioecol 40(2):149-153, 2000

[Y] **Opioid receptor subtypes that mediate a microwave-induced decrease in central cholinergic activity in the rat.** VIEW
Lai H, Carino MA, Horita A, Guy AW,
Bioelectromagnetics 13(3):237-246, 1992

[Y] **Opioid receptor subtypes that mediate a microwave-induced decrease in central cholinergic activity in the rat.** VIEW
Lai H, Carino MA, Horita A, Guy AW
Bioelectromagnetics. 1992. 13(3). P 237-46. 1992

[Y] **Oxidative Damage in the Kidney Induced by 900-MHz-Emitted Mobile Phone: Protection by Melatonin.** VIEW
Oktem F, Ozguner F, Mollaoglu H, Koyu A, Uz E.
Arch Med Res.36(4):350-355, 2005

[Y] **Oxidative stress-mediated skin damage in an experimental mobile phone model can be prevented by melatonin.** VIEW
Ayata A, Mollaoglu H, Yilmaz HR, Akturk O, Ozguner F, Altuntas I.
J Dermatol. 31(11):878-883, 2004

[Y] **Permeability of the blood-brain barrier induced by 915 MHz electromagnetic radiation, continuous wave and modulated at 8, 16, 50, and 200 Hz.** VIEW
Salford LG, Brun A, Sturesson K, Eberhardt JL, Persson BR
Microsc Res Tech 27(6):535-542, 1994

[Y] **Pharmacologic correction of learning and memory disorders induced by exposure to high-frequency electromagnetic radiation** VIEW
Krylov IN, Iasnetsov VV, Dukhanin AS, Pal'tsev IuP,
Biull Eksp Biol Med 115(3):260-262, 1993

[Y] **Physiological changes in rats after exposure to low levels of microwaves.** VIEW
Ray S, Behari J,
Radiat Res 123(2):199-202, 1990

[Y] **Prevention of mobile phone induced skin tissue changes by melatonin in rat** VIEW
Ozguner F, Aydin G, Mollaoglu H, Gokalp O, Koyu A, Cesur G.
Toxicol Ind Health. 20(6-10):133-139, 2004

[Y] **Primary brain tumor incidence in mice exposed to split-dose ionizing radiation and circularly polarized 60 Hz magnetic fields.** VIEW
Kharazi AI, Babbitt JT, Hahn TJ
Cancer Lett 1999 Dec 1;147(1-2):149-56 1999 **NOTE: 50/60 Hz study**

[Y] **Protective effects of melatonin and caffeic acid phenethyl ester against retinal oxidative stress in long-term use of mobile phone:** VIEW
Ozguner F, Bardak Y, Comlekci S.
A comparative study. Mol Cell Biochem. 282(1-2):83-88, 2006

[Y] **Psychoactive-drug response is affected by acute low-level microwave irradiation.** VIEW
Lai H, Horita A, Chou CK, Guy AW
Bioelectromagnetics. 1983. 4(3). P 205-14. 1983

[Y] **Qualitative enzyme histochemistry and microanalysis reveals changes in ultrastructural distribution of calcium and calcium-activated ATPases after microwave irradiation of the medial habenula** VIEW
Kittel A, Siklos L, Thuroczy G, Somosy Z,
Acta Neuropathol (Berl) 92(4):362-368, 1996

[Y] **Radiofrequency-induced carcinogenesis: cellular calcium homeostasis changes as a triggering factor.** VIEW
Anghileri LJ, Mayayo E, Domingo JL, Thouvenot P.
Inter. J. Rad. Biol. 81(3):205-209, 2005

[Y] **Repeated exposure to low-level extremely low frequency-modulated microwaves** VIEW
Vorobyov V, Pesic V, Janac B, Prolic Z.
Int J Radiat Biol. 80(9):691-698, 2004

[Y] **Responses of neurons to an amplitude modulated microwave stimulus.** VIEW
Beason RC, Semm P
Neurosci Lett 333(3):175-178, 2002

[Y] **Responses of pulmonary intravascular macrophages to 915-MHz microwave radiation: ultrastructural and cytochemical study.** VIEW
Singh B, Bate LA
Anat Rec 246(3):343-355, 1996

[Y] **Rhesus monkey behavior during exposure to high-peak-power 5.62-GHz microwave pulses.** VIEW
D'Andrea JA, Thomas A, Hatcher DJ,
Bioelectromagnetics 15(2):163-176, 1994

[Y] **Sequential changes in cerebral blood flow, early neuropathological consequences and BBB disruption, following RF-induced localized hyperthermia in the rat.** VIEW
Ohmoto Y, Fujisawa H, Ishikawa T, Koizumi H, Matsuda T, Ito H,
Int J Hyperthermia 12(3):321-334, 1996

[Y] **Simultaneous response of brain electrical activity (EEG) and cerebral circulation (REG) to microwave exposure in rats.** VIEW
Thuroczy G, Kubinyi G, Bodo M, Bakos J, Szabo LD
Rev Environ Health 10(2):135-148, 1994

[Y] **Single vs. repeated microwave exposure: effects on benzodiazepine receptors in the brain of the rat.** VIEW
Lai H, Carino MA, Horita A, Guy AW,
Bioelectromagnetics 13(1):57-66, 1992

[Y] **Single vs. repeated microwave exposure: effects on benzodiazepine receptors in the brain of the rat.** VIEW
Lai H, Carino MA, Horita A, Guy AW
Bioelectromagnetics. 1992. 13(1). P 57-66. 1992

[Y] **Some biochemical indexes in white rabbit's blood affected by acute high intensity microwave** VIEW
Li C, Zhan C, Long Y, Gu H, Deng Y, Jiang Y, Tang M, Tang C, Luo S,
Hua Hsi I Ko Ta Hsueh Hsueh Pao ;26(2):206-209, 1995

[Y] **Spatial learning deficit in the rat after exposure to a 60 Hz magnetic field.** VIEW
Lai H
Bioelectromagnetics. 1996. 17(6). P 494-6. 1996 **NOTE: 50/60 Hz study**

[Y] **Species specificity, age factors, and various neurochemical correlates of the animal spontaneous behavior after exposure to WMF of the ultra-low intensity** VIEW
Shtemberg AS, Uzbekov MG, Shikhov SN, Bazian AS, Cherniakov GM,
Zh Vyssh Nerv Deiat Im I P Pavlova 50(4):703-715, 2000

[Y] **Spontaneous and nitrosourea-induced primary tumors in the central nervous system of rats exposed to 836MHz.** VIEW
Adey WR, Byus CV, Cain CD, Higgins RJ, Keau CJ, Kuster N, MacMurray A, Stagg RB, Zimmerman G, Phillips JL, Haggren W
Radiation Research 152:293-302 1999

[Y] **Spontaneous and nitrosourea-induced primary tumors of the central nervous system in Fischer 344 rats exposed to frequency-modulated microwave fields.** VIEW
Adey WR, Byus CV, Cain CD, Higgins RJ, Jones RA, Kean CJ, Kuster N, MacMurray A, Stagg RB, Zimmerman G,
Cancer Res 60(7):1857-1863, 2000

[Y] **Spontaneous and nitrosourea-induced primary tumors of the CNS in rats chronically exposed to 836 MHz modulated microwaves** VIEW
Adey WR, Byus CV, Cain CD, Higgins RJ, Jones RA, Kean CJ, Kuster N, MacMurray A, Stagg RB, Zimmerman G, Phillips JL, Haggren W,
Radiat Res 152(3):293-302, 1999

[Y] **Stimulation of production of tumor necrosis factor by murine macrophages when exposed in vivo and in vitro to weak EMF in the centimeter range** VIEW
Novoselova ET, Fesenko EE
Biofizika 43(6):1132-11333, 1998

[Y] **Structural and kinetic effects of mobile phone microwaves on acetylcholinesterase activity** VIEW
Barteri M, Pala A, Rotella S.
Biophys Chem. 113(3):245-253, 2005

[Y] **Study on the effects of microwave irradiation on ultramicrostructure of hypothalamus in mice.** VIEW
Yao GD, Chiang H
Radiation Protection 5:191-195, 1985

[Y] **Suppression of evoked and spontaneous field potentials by radiofrequency radiation in rat hippocampal slices.** VIEW
Tattersell JEH, Nettell JJ, Wood SJ
Presented at the Twentieth Annual Meeting of the Bioelectromagnetics Society, St. Pete Beach, FL, June 1998

[Y] **Suppression of nonspecific resistance of the body under the effect of extremely high frequency electromagnetic radiation of low intensity** VIEW
Kolomytseva MP, Gapeev AB, Sadovnikov VB, Chemeris NK.
Biofizika. 47(1):71-77, 2002

[Y] **Temporal bisection in rats: the effects of high-peak-power pulsed microwave irradiation** VIEW
Raslear TG, Akyel Y, Bates F, Belt M, Lu ST
Bioelectromagnetics 14(5):459-478, 1993

[Y] **The effect of low level continuous 2.45 GHz waves on enzymes of developing rat brain** VIEW
Paulraj R, Behari J
Electromag. Biol. Med. 21:221-231, 2002

[Y] **The effect of ultrahigh-frequency electromagnetic radiation on learning and memory processes** VIEW
Krylova IN, Dukhanin AS, Il'in AB, Kuznetsova Elu, Balaeva NV, Shimanovskii NL, Pal'tsev IuP, Iasnetsov VV
Biull Eksp Biol Med 114(11):483-484, 1994

[Y] **The effects of 3000 MHz microwave irradiation on electroencephalic energy and energy metabolism in mouse brain.** VIEW
Pu JS, Chen J, Yang YH, Bai YQ
Electro-and Magneto-biology 16:243-247, 1997

[Y] **The Effects of Whole Body Cell Phone Exposure on the T1 Relaxation Times and Trace Elements in the Serum of Rats** VIEW
Aksen F, Dasdag S, Akdag MZ, Askin M, Dasdag MM.
Biol. Med. 23:7-11, 2004

[Y] **The modification of the effect of microwave radiation on the biochemical processes in anaphylactic shock by using exposure to a weak and perturbed geomagnetic field** VIEW
Podkovkin VG
Radiobiologiia 33(1):166-169, 1993

[Y] **The participation of thyroid hormones in modifying the mutagenic effect of microwaves** VIEW
Koveshnikova IV, Antipenko EN
Radiobiologiia 31(1):147-149, 1991

[Y] **The Production of Tumor Necrosis Factor in Cells of Tumor-Bearing Mice After Total-Body Microwave Irradiation and Antioxidant Diet.** VIEW
Novoselova EG, Ogay VB, Sorokina OV, Glushkova OV, Sinotova OA, Fesenko EE.
Electromag. Biol. Med. 23:167-180, 2004

[Y] **The relationship between colony-forming ability, chromosome aberrations and incidence of micronuclei in V79 Chinese hamster cells exposed to microwave radiation.** VIEW
Garaj-Vrhovac V, Horvat D, Koren Z,
Mutat Res 263(3):143-149, 1991

[Y] **Total bioelectric activity of various structures of the brain in low-intensity microwave irradiation** VIEW
Grigor'ev IuG, Luk'ianova SN, Makarov VP, Rynskov VV
Radiats Biol Radioecol 35(1):57-65, 1995

[Y] **Transgenic nematodes as biomonitors of microwave-induced stress.** VIEW
Daniells C, Duce I, Thomas D, Sewell P, Tattersall J, de Pomerai D,
Mutat Res 399:55-64, 1998

[Y] **Ultrawide-band electromagnetic pulses induced hypotension in rats.** VIEW
Lu ST, Mathur SP, Akyel Y, Lee JC
Physiol Behav Jan 1-15; 65(4-5):753-761, 1999; Corrected and republished in Physiol Behav; 67(3):753-761, 1999

[Y] **Whole-body microwave exposure emitted by cellular phones and testicular function of rats.** VIEW
Dasdag S, Ketani MA, Akdag Z, Ersay AR, Sari I, Demirtas OC, Celik MS
Urol Res 27(3):219-223, 1999

IN VITRO (223)

[N] **1800 MHz radiofrequency (GSM) does not affect apoptosis and heat shock protein 70 level in peripheral blood mononuclear cells from young and old donors** VIEW
Capri M, Scarcella E, Bianchi E, Fumelli C, Mesirca P, Agostini C, Remondini D, Schuderer J, Kuster N, Franceschi C, Bersani F
Int J Radiat Biol. 80(6):389-397, 2004

[N] **915 MHz microwaves and 50 Hz magnetic fields on human lymphocytes from hypersensitive and healthy persons.** VIEW
Belyaev IY, Hillert L, Protopopova M, Tamm C, Malmgren LO, Persson BR, Selivanova G, Harms-Ringdahl M.
Bioelectromagnetics. 26(3):173-184, 2005

[N] **954 MHz microwaves enhance the mutagenic properties of mitomycin C** VIEW
Maes A, Collier M, Slaets D, Verschaeve L,
Environ Mol Mutagen 28(1):26-30, 1996

[N] **Activation of the hsp27/p38MAPK stress pathway by EMF in human endothelial cells: Molecular mechanism for cancer- and BBB-related effects** VIEW
Leszczynski D, Joenväärä S, Reivinen J, Kuokka R,
Differentiation 70:120 129, 2002

[N] **Application of intracellular microelectrophoresis to analysis of the influence of the low-level microwave radiation on electrokinetic properties of nuclei in human epithelial cells.** VIEW
Shckorbatov YG, Shakhbazov VG, Navrotskaya VV, Grabina VA, Sirenko SP, Fisun AI, Gorobets NN, Kiyko VI
Electrophoresis 23(13):2074-2079, 2002

[N] **Biological and morphological effects on the brain after exposure of rats to a 1439 MHz TDMA field.** VIEW
Tsurita G, Nagawa H, Ueno S, Watanabe S, Taki M,
Bioelect romagnetics 21(5):364-371, 2000

[N] **Bursting responses of Lymnea neurons to microwave radiation.** VIEW
Bolshakov MA, Alekseev SI,
Bioelectromagnetics 13(2):119-129, 1992

[N] **Calcium-ion movement and contractility in atrial strips of frog heart are not affected by low-frequency-modulated, 1 GHz electromagnetic radiation.** VIEW
Schwartz JL, Mealing GA,
Bioelectromagnetics 14(6):521-533, 1993

[N] **Cell proliferation, sister-chromatid exchange, chromasolam aberrations, micronuclei and mutation rate.** VIEW
Diener S, Eberle P,
Electronic Compatability of Biological Systems 1997. Newsletter Edition Wissenschaft Nr.4 1996

[N] **Changes on Cellular Proteins due to Environmental Non-ionizing Radiation heat-shock proteins** VIEW
Kwee S, Raskmark P, Velizarov S.
Electromag. Biol. Med. 20:141-152, 2001

[N] **Character of the effect of microwave on conduction velocity of frog ventricular muscle.** VIEW
Yee KC, Chou CK, Guy AW,
Bioelectromagnetics 15(6):555-561, 1994

[N] **Chromosome damage and micronucleus formation in human blood lymphocytes exposed in vitro to radiofrequency radiation at a cellular telephone frequency (847.74 MHz, CDMA).** VIEW
Vijayalaxmi, Bisht KS, Pickard WF, Meltz ML, Roti Roti JL, Moros EG
Radiat Res 156(4):430-432, 2001

[N] **Comparative effects of extremely high power microwave pulses and a brief CW irradiation on pacemaker function in isolated frog heart slices** VIEW
Pakhomov AG, Mathur SP, Doyle J, Stuck BE, Kiel JL, Murphy MR,
Bioelectromagnetics 21(4):245-254, 2000

[N] **Cytogenetic effects of 900 MHz (GSM) microwaves on human lymphocytes.** VIEW
Maes A, Collier M, Verschaeve L
Bioelectromagnetics 22(2):91-96, 2001

[N] **Cytogenetic investigations on microwaves emitted by a 455.7 MHz car phone** VIEW
Maes A, Collier M, Verschaeve L
Folia Biol (Praha) 46(5):175-180, 2000

[N] **Cytogenetic Studies in Human Blood Lymphocytes** VIEW
Vijayalaxmi , Leal BZ, Meltz ML, Pickard WF, Bisht KS, Roti Roti JL , Straube WL, Moros EG,
Radiat Res 155(1):113-121, 2001

[N] **DNA and protein exposed to modulated RF fields.** VIEW
Ruger W, Hansen I
Presented at Second World Congress in Bologna, Italy 1997; published in Edition Wissenschaft Nr.8 1996

[N] **DNA Damage and Micronucleus Induction in Human Leukocytes after Acute In Vitro Exposure to a 1.9 GHz CW RF.** VIEW
McNamee JP, Bellier PV, Gajda GB, Miller SM, Lemay EP, Lavallee BF, Marro L, Thansandote A
Radiat Res 158(4):523-533, 2002

[N] **DNA damage in frog erythrocytes after in vitro exposure to a high peak-power pulsed electromagnetic field.** VIEW
Chemeris NK, Gapeyev AB, Sirota NP, Gudkova OY, Kornienko NV, Tankanag AV, Konovalov IV, Buzoverya ME, Suvorov VG, Logunov VA
Mutat Res. 558(1-2):27-34, 2004

[N] **DNA Damage in Human Leukocytes after Acute In Vitro Exposure to a 1.9 GHz Pulse-Modulated Radiofrequency Field** VIEW
McNamee JP, Bellier PV, Gajda GB, Lavallee BF, Lemay EP, Marro L, Thansandote A.
Radiat Res 158(4):534-537, 2002

[N] **DNA strand breaks not induced in human cells exposed to 2.1425 GHz band CW and W-CDMA base stations.** VIEW
Sakuma N, Komatsubara Y, Takeda H, Hirose H, Sekijima M, Nojima T, Miyakoshi J.
Bioelectromagnetics. Nov 10; 2005

[N] **DNA synthesis and cell proliferation in C_6 glioma and primary glial cells exposed to 836.55 MHz modulate RF.** VIEW
Stagg RB, Thomas WJ, Jones RA, Adey WR
Bioelectromagnetics 18: 230-236 1997

[N] **Do 27 MHz and 2450 MHz radiation affect *in vitro* proliferation of human LN-71 glioma cells** VIEW
Shi R, Davis CC, Motkin SM
Presented at BEMS in Long Beach, Calif 1999

[N] **Do weak RF fields influence the calcium regulation in hamster pinealocytes and human retinoblastoma cells?** VIEW
Gollnick F, Lerchl A, Neihaus M, Brendal H, Hansen VW, Meyer R
Presented at BEMS Long Beach California 1999

[N] **Does 835 MHz FMCW irradiation alter Nitric Oxide production by the J447.16 mouse macrophage cell line?** VIEW
Spitz DR, Sim JE, Rodnour LA
Presented at BEMS in Victoria, BC 1996

[N] **Dose dependence of acetylcholinesterase activity in neuroblastoma cells exposed to modulated radio-frequency electromagnetic radiation.** VIEW
Dutta SK, Das K, Ghosh B, Blackman CF
Bioelectromagnetics 13(4):317-322, 1992

[N] **Effect of cisplatinum and 2450 MHz EMR on DNA damage measured by the alkaline comet assay.** VIEW
LaGroye I, Wettring BA, Moros EG, Straube WL, Pickard WF, Roti-Roti JL
Presented at BEMS in Long Beach, California 1999

[N] **Effect of high-frequency electromagnetic fields with a wide range of SARs on chromosomal aberrations in murine m5S cells** VIEW
Komatsubara Y, Hirose H, Sakurai T, Koyama S, Suzuki Y, Taki M, Miyakoshi J.
Mutat Res. 587(1-2):114-119, 2005

[N] **Effect of low power microwave on the mouse genome: a direct DNA analysis.** VIEW
Sarkar S, Ali S, Behari J,
Mutat Res 320(1-2):141-147, 1994

[N] **Effect of microwave radiation on permeability of liposomes. Evidence against non-thermal leakage.** VIEW
Bergqvist B, Arvidsson L, Pettersson E, Galt S, Saalman E, Hamnerius Y, Norden B,
Biochim Biophys Acta 1201(1):51-54, 1994

[N] **Effects of 2.45 GHz microwave fields on liposomes entrapping glycoenzyme ascorbate oxidase** VIEW
Ramundo-Orlando A, Liberti M, Mossa G, D'Inzeo G
Bioelectromagnetics. 25(5):338-345, 2004

[N] **Effects of 900 MHz electromagnetic fields exposure on cochlear cells' functionality in rats:** VIEW
Galloni P, Lovisolo GA, Mancini S, Parazzini M, Pinto R, Piscitelli M, Ravazzani P, Marino C.
Bioelectromagnetics. Jul 21; 2005

[N] **Effects of high frequency EMF on human lymphocytes *in vitro*.** VIEW
Antonopolous A, Obe G
Edition Wissenschaft Nr.14 1998; Electronic Compatability of Biological Systems 1997; Mutation Research 395 (2-3); 209-214, 1997

[N] **Effects of high-frequency electromagnetic fields on human lymphocytes in vitro** VIEW
Antonopoulos A, Eisenbrandt H, Obe G,
Mutat Res 395(2-3) :209-214, 1997

[N] **Effects of microwave and radio frequency EMFs on lichens.** VIEW
Urech M, Eicher B, Siegenthaler J
Bioelectromagnetics 17(4):327-334, 1996

[N] **Effects of mobile phone type signals on calcium levels within human leukaemic T-cells (Jurkat cells)** VIEW
Cranfield CG, Wood AW, Anderson V, Menezes KG.
Int J Radiat Biol 77(12):1207-1217, 2001

[N] **Effects of Universal Mobile Telecommunications System (UMTS) Electromagnetic Fields on the Blood-Brain Barrier** VIEW
Franke H, Streckert J, Bitz A, Goeke J, Hansen V, Ringelstein EB, Nattkamper H, Galla HJ, Stogbauer F
In Vitro. Radiat Res. 164(3):258-269, 2005

[N] **Electromagnetic Fields on Nonthermal Induction of Heat-Shock Proteins in Human Leukocytes.** VIEW
Lim HB, Cook GG, Barker AT, Coulton LA.
Radiat Res. 163(1):45-52, 2005

[N] **Evaluation of Parameters of Oxidative Stress after In Vitro Exposure to FMCW- and CDMA-Modulated RF** VIEW
Hook, G. J., Spitz, D. R., Sim, J. E., Higashikubo, R., Baty, J. D., Moros, E. G.

and Roti Roti, J. L
Radiat. Res. 162, 497 -504, 2004

[N] **Experimental study and mechanism analysis on cell electroporation due to low-intensity transient electromagnetic pulses** VIEW
Liu CJ, Wang BY, Zhang H, Wang ZS, Chen MF
Chin Science Bulletin 44:1157-1161, 1999

[N] **Exposure of magnetic bacteria to simulated mobile phone-type RF radiation has no impact on mortality.** VIEW
Cranfield CG, Wieser HG, Dobson J
IEEE Trans Nanobioscience. 2(3):146-149, 2003

[N] **Expression of the Proto-oncogene Fos after Exposure to Radiofrequency Radiation Relevant to Wireless Communications.** VIEW
Whitehead TD, Brownstein BH, Parry JJ, Thompson D, Cha BA, Moros EG, Rogers BE, Roti Roti JL.
Radiat Res. 164(4):420-430, 2005

[N] **Focus formation of C3H/10T1/2 cells and exposure to 836.55 MHz modulated RF.** VIEW
Cain CD, Thomas DL, Adey WR,
Bioelectromagnetics 18:237-243 1997

[N] **Focus formation of C3H/10T1/2 cells and exposure to a 836.55 MHz modulated radiofrequency field.** VIEW
Cain CD, Thomas DL, Adey WR,
Bioelectromagnetics 18(3):237-243, 1997

[N] **Genotoxicity of RF fields generated from analog, TDMA, CDMA and PCS technology, evaluated using a Three-test In Vitro battery.** VIEW
Hook GJ, Phillips LA, Blackwell DM, Clancy JJ, Donner EM, Tice RR, McRee D
Presented at BEMS in Long Beach, California 1999

[N] **Growth behaviour of human leukemia HL-60 cells influenced by high-frequency EMFs.** VIEW
Fitzner R, Langer E, Zemann E,
Presented at BEMS in Florida, 1998. And also at the Second World Congress of E & M in Bologna Italy 1997. Published in Newsletter edition Wissenschaft Nr 1/E 1995

[N] **Hsp70 expression and free radical release after exposure to non-thermal radio-frequency electromagnetic fields and ultrafine particles in human Mono Mac 6 cells.** VIEW
Simko M, Hartwig C, Lantow M, Lupke M, Mattsson MO, Rahman Q, Rollwitz J.
Toxicol Lett. 161(1):73-82, 2006

[N] **Human lymphocyte micronucleus assay as biological indicator of cytogenetic damage by microwave radiation** VIEW
Zotti Martelli L, Peccatori M, Migliore L,
Publication unknown - probably 1998

[N] **In vitro effects of GSM modulated radiofrequency fields on human immune cells.** VIEW
Tuschl H, Novak W, Molla-Djafari H.
Bioelectromagnetics. Dec 8; 2005

[N] **In vitro lymphocyte proliferation induced by radio-frequency electromagnetic radiation under isothermal conditions.** VIEW
Cleary SF, Liu LM, Merchant RE,
Bioelectromagnetics 11(1):47-56, 1990

[N] **Inactivation of Lactobacillus bacteriophage PL-1 by microwave irradiation.** VIEW
Kakita Y, Kashige N, Murata K, Kuroiwa A, Funatsu M, Watanabe K,
Microbiol Immunol 39(8):571-576, 1995

[N] **Influence of RFR on chromosome aberrations in CHO cells and its interaction with DNA-damaging agents.** VIEW
Kerbacher JJ, Meltz ML, Erwin DN,
Radiat Res 123(3):311-319, 1990

[N] **Is the heat shock response activated by exposure to RF fields?** VIEW
Laszlo A, Chen MS, Davidson T
Presented at the Second world Congress for Electricity and Magnetism in Biology and Medicine, Bologna Italy, 1997

[N] **Lack of Genotoxic Effects (Micronucleus Induction) in Human Lymphocytes Exposed In Vitro to 900 MHz Electromagnetic Fields.** VIEW
Zeni O, Schiavoni AS, Sannino A, Antolini A, Forigo D, Bersani F, Scarfi MR
Radiat. Res. 160, 152-158, 2003

[N] **Lack of Mutation Induction with Exposure to 1.5 GHz Electromagnetic Near Fields Used for Cellular Phones in Brains of Big Blue Mice.** VIEW
Takahashi S, Inaguma S, Cho Y-M, Imaida K, Wang J, Fujiwara O, Shirai T,
Cancer Res 62:1956-1960, 2002

[N] **Lack of neoplastic transformation in C3H10T1/2 cells following exposure to cellular phone communications frequencies.** VIEW
Malyapa RS, Aher EW, Moros EG, Strube WL, Pickard WF, Roti-Roti JL
Presented at BEMS in St Petersburg, Florida 1998

[N] **Measurement of DNA damage after acute exposure to 2450 MHz microwaves in rat brain cells.** VIEW
LaGroye I, Wettring BA, Moros EG, Straube WL, Pickard WF, Roti-Roti JL, Anane, LaRegina MA, Niehoff x
Presented at the 21st Annual BEMS meeting in Long Beach, California, 1999

[N] **Measurement of DNA damage after exposure to 2450 MHz electromagnetic radiation.** VIEW
Malyapa RS, Ahern EW, Straube WL, Moros EG, Pickard WF, Roti Roti JL,
Radiat Res 148(6):608-617, 1997

[N] **Measurement of DNA damage and apoptosis in molt-4 cells after in vitro exposure to radiofrequency radiation.** VIEW
Hook GJ, Zhang P, Lagroye I, Li L, Higashikubo R, Moros EG, Straube WL, Pickard WF, Baty JD, Roti Roti JL.
Radiat Res. 161(2): 193-200, 2004

[N] **Measurement of DNA damage following exposure to EMR in the cellular communications frequency band (835.62 and 847.74 MHz).** VIEW
Malyapa RS, Ahern EW, Straube WL, Moros EG, Pickard WF, Roti-Roti J
Radiation Research 148: 618-627 1997

[N] **Measurement of DNA damage in mammalian cells exposed in vitro to radiofrequency fields at sars of 3-5 w/kg.** VIEW
Li L, Bisht KS, LaGroye I, Zhang P, Straube WL, Moros EG, Roti Roti JL.
Radiat Res 156:328-332, 2001

[N] **Measurements of Alkali-Labile DNA Damage and Protein-DNA Crosslinks after 2450 MHz Microwave and Low-Dose Gamma Irradiation In Vitro.** VIEW
Lagroye I, Hook GJ, Wettring BA, Baty JD, Moros EG, Straube WL, Roti Roti JL
Radiat Res. 161(2): 201-214, 2004

[N] **Membrane potential and currents of isolated heart muscle cells exposed to pulsed radio frequency fields.** VIEW
Linz KW, von Westphalen C, Streckert J, Hansen V, Meyer R
Bioelectromagnetics 20(8):497-511, 1999

[N] **Mobile phone type EMFs do not influence genetic stability in yeast.** VIEW
Gos P
Presented at Seocnd World Congress in Bologna, Italy 1997

[N] **Neoplastic Transformation in C3H 10T(1/2) Cells after Exposure to 835.62 MHz FDMA and 847.74 MHz CDMA Radiations.** VIEW
Roti Roti JL , Malyapa RS, Bisht KS, Ahern EW, Moros EG, Pickard WF, Straube WL,
Radiat Res 155(1):239-247, 2001

[N] **Non-thermal Exposure to RFE from Digital Wireless Phones does not Affect ODC Activity in L929** VIEW
Desta AB, Owen RD, Cress LW
Cells. Radiat Res 160:488491, 2003

[N] **Nuclear matrix protein composition following exposure to 835.62 MHz FMCW, 847.74 MHz CDMA or moderate hyperthermia.** VIEW
Wright WD, Straube W, Pickard W, Moros E, Roti-Roti J
Presented at BEMS in St Petersburg, Florida, 1998, Bioelectromagnetics, submitted 1990

[N] **Preliminary microwave irradiation of water solutions changes their channel-modifying activity.** VIEW
Fesenko EE, Geletyuk VI, Kazachenko VN, Chemeris NK,
FEBS Lett 366(1):49-52, 1995

[N] **Primary DNA Damage in Human Blood Lymphocytes Exposed In Vitro to 2450 MHz Radiofrequency** VIEW
Vijayalaxmi, Leal BZ, Szilagyi M, Prihoda TJ, Meltz ML
Radiation. Radiat Res 153(4):479-486, 2000

[N] **Proflavin and microwave radiation: absence of a mutagenic interaction.** VIEW
Meltz ML, Eagan P, Erwin DN,
Bioelectromagnetics 11(2):149-157, 1990

[N] **Proliferation and cytogenetic studies in human blood lymphocytes exposed in vitro to 2450 MHz radiofrequency radiation.** VIEW
Vijayalaxmi, Mohan N, Meltz ML, Wittler MA
Int J Radiat Biol 72(6):751-757, 1997

[N] **Radiofrequency Electromagnetic Fields do not Alter the Cell Cycle Progression of C3H 10T and U87MG Cells** VIEW
Higashikubo R, Ragouzis M, Moros EG, Straube WL, Roti Roti JL.
Radiat Res 156(6):786-795, 2001

[N] **Repeated Exposure of C3H/HeJ Mice to Ultra-wideband Electromagnetic Pulses: Lack of Effects on Mammary Tumors.** VIEW

Jauchem JR, Frei MR, Dusch SJ, Lehnert HM, Kovatch RM,
Radiat Res 155(2):369-377, 2001

[N] **Stress proteins are not induced in mammalian cells exposed to radiofrequency or microwave radiation.** VIEW
Cleary SF, Cao G, Liu LM, Egle PM, Shelton KR,
Bioelectromagnetics 18(7):499-505, 1997

[N] **The Effect of 835.62 MHz FDMA or 847.74 MHz CDMA Modulated RFR on the Induction of Micronuclei in C3H 10T* Cells** VIEW
Bisht KS, Moros EG, Straube WL, Baty JD, Roti Roti JL,
Radiat. Res. 157, 506515, 2002

[N] **The effect of exposure to radio frequency EMF on the proliferation of the 9L brain tumour In vivo** VIEW
Culbreth WP, Spitz DR, Pickard WF, LaRegina MA, Straube W, Moros E, Gutting KM, Kuepfort HL, Roti-Roti JL, Higashinkubo R,
Radiation Research (submitted) 1998

[N] **The effect of microwave radiation on the cell genome.** VIEW
Garaj-Vrhovac V, Horvat D, Koren Z
Mutat Res 243(2):87-93, 1990

[N] **The effects of low level microwaves on the fluidity of photoreceptor cell membrane.** VIEW
Pologea-Moraru R, Kovacs E, Iliescu KR, Calota V, Sajin G
Bioelectrochemistry 56(1-2):223-225, 2002

[N] **The Heat-Shock Factor is not Activated in Mammalian Cells Exposed to Cellular Phone Frequency Microwaves.** VIEW
Laszlo, A., Moros, E. G., Davidson, T., Bradbury, M., Straube, W. and Roti Roti, J.
Radiat. Res. 164, 163-172, 2005

[N] **The influence of high frequency EMF on the intracellular calcium concentrations of excitable and non-ecitable cells.** VIEW
Meyer R, Gollnick F, Wolke S
Presented at URSI 26th General Assembly in Toronto 1999; BEMS in St Petersburg Florida 1998; published in Electronic compatibility of Biological Systems 1997; and in Edition Wissenschaft 2, 1998; and NR 10 1996; and Bielctromagnetics 17:144-153 1996

[N] **The simulation of the cooperative effect of development in a culture of early mouse embryos after irradiation with electromagnetic waves in the millimeter range** VIEW
Mezhevikina LM, Khramov RN, Lepikhov KA ,
Ontogenez 31(1):27-31, 2000

[N] **Tight junctional changes upon microwave and x-ray irradiation.** VIEW
Palfia Z, Somosy Z, Rez G.
Acta Biol Hung 52(4):411-416, 2001

[N] **TP53 tumor suppressor protein in normal human fibroblasts does not respond to 837 MHz microwave exposure.** VIEW
Li JR, Chou CK, McDougall JA, Dasgupta G, Wu HH, Ren RL, Lee A, Han J, Momand J
Radiat Res 151(6):710-716, 1999

[NA] **2D plasmon excitation and nonthermal effects of microwaves on biological membranes.** VIEW
Fisun OI,
Bioelectromagnetics 14(1):57-66, 1993

[NA] **Bacterial mutation in high magnetic fields and radiofrequency radiation** VIEW
Mineta M, Katada R, Yamada T, Nagasawa K, Takahashi K, Aburano T, Yoshida I,
Nippon Igaku Hoshasen Gakkai Zasshi 59(9):467-469, 1999

[NA] **Monitoring of human exposure to radiation with the binucleated lymphocyte micronucleus assay.** VIEW
He JL, Jin HY, Jin LF, Gao SY,
Biomed Environ Sci 13(1):32-36, 2000

[NA] **Ultra-wide band electromagnetic radiation does not affect UV-induced recombination and mutagenesis in yeast** VIEW
Pakhomova ON, Belt ML, Mathur SP, Lee JC, Akyel Y,
Bioelectromagnetics 19(2):128-130, 1998

[Y] **1800 MHz electromagnetic field effects on melatonin release from isolated pineal glands.** VIEW
Sukhotina I, Streckert JR, Bitz AK, Hansen VW, Lerchl A
J Pineal Res. 40(1):86-91, 2006

[Y] **2.45GHz radiofrequency fields alter gene expression in cultured human cells.** VIEW
Lee S, Johnson D, Dunbar K, Dong H, Ge X, Kim YC, Wing C, Jayathilaka N, Emmanuel N, Zhou CQ, Gerber HL, Tseng CC, Wang SM
FEBS Lett. 579(21):4829-4836, 2005

[Y] **837 MHz digital cellular telephone RF fields and induced ODC activity in C3H10T1/2 cells.** VIEW
Cain CD, Thomas DL, Ghaffari M, Adey WR,
Presented at BEMS in Victoria, BC 1996

[Y] **A polymerase chain reaction assay for simultaneous detection and quantitation of proto-oncogene and GAPD mRNAs.** VIEW
Albee LD, Goswami PC
Cell Proliferation 30:271-282 1998

[Y] **Acute exposure to 930 MHz CW EMR in vitro affects reactive oxygen species level in rat lymphocytes treated by iron ions.** VIEW
Zmyslony M, Politanski P, Rajkowska E, Szymczak W, Jajte J
Bioelectromagnetics. 25(5):324-328, 2004

[Y] **Acute exposure to 930 MHz CW EMR in vitro affects reactive oxygen species level in rat lymphocytes treated by iron ions.** VIEW
Zmyslony M, Politanski P, Rajkowska E, Szymczak W, Jajte J
Bioelectromagnetics. 25(5):324-328, 2004

[Y] **Acute low-intensity microwave exposure increases DNA single-strand breaks in rat brain cells** VIEW
Lai H, Singh NP,
Bioelectromagnetics 16(3):207-210, 1995

[Y] **Altered restriction patterns of microwave irradiated lambdaphage DNA** VIEW
Narasimhan V, Huh WK
Biochem Int 25(2):363-370, 1991

[Y] **Bioeffects induced by exposure to microwaves are mitigated by superposition of ELF noise.** VIEW
Litovitz TA, Penafiel LM, Farrel JM, Krause D, Meister R, Mullins JM
Bioelectromagnetics 18(6):422-430, 1997

[Y] **Calcium homeostasis of isolated heart muscle cells exposed to pulsed high-frequency electromagnetic fields.** VIEW
Wolke S, Neibig U, Elsner R, Gollnick F, Meyer R
Bioelectromagnetics 17(2):144-153, 1996

[Y] **Cell cycle alterations induced by isothermal 27 MHz radio-frequency radiation exposure.** VIEW
Cao G, Liu LM, Cleary SF,
Bioelectrochem Bioenerg 37(2):131-140, 1995

[Y] **Cell-to-cell communication in response of E. coli cells at different phases of growth to low-intensity microwaves.** VIEW
Shcheglov VS, Alipov ED, Belyaev IY
Biochim Biophys Acta 1572(1):101-106, 2002

[Y] **Changes in cell proliferation due to environmental non-ionizing radiation** VIEW
Kwee S, Raskmark P,
Bioelectrochem Bioenerg 44(2) 251-255, 1998

[Y] **Changes in cellular Proteins due to environmental Non-ionising radiation** VIEW
Kwee S, Raskmark P, Velizarov P.
Electro- and Magnetobiology 20: 141-152, 2001

[Y] **Changes in the dielectric properties of rat tissue as a function of age at microwave frequencies** VIEW
Peyman A, Rezazadeh AA, Gabriel C
Phys Med Biol 46(6):1617-1629, 2001

[Y] **Changes in the secondary structure of DNA under the influence of external low-intensity electromagnetic field** VIEW
Semin IuA, Shvartsburg LK, Dubovik BV
Radiats Biol Radioecol 35(1):36-41, 1995

[Y] **Cytogenetic damage in human lymphocytes following GMSK phase modulated microwave exposure.** VIEW
d'Ambrosio G, Massa R, Scarfi MR, Zeni O
Bioelectromagnetics 23:7-13, 2002

[Y] **Cytogenetic effects of 50 Hz magnetic fields of different magnetic flux densities.** VIEW
Maes A, Collier M, Vandoninck S, Scarpa P, Verschaeve L,
Bioelectromagnetics 21(8):589-596, 2000 **NOTE: 50/60 Hz study**

[Y] **Cytogenetic effects of 935.2-MHz (GSM) microwaves alone and in combination with mitomycin** VIEW
Maes A, Collier M, Van Gorp U, Vandoninck S, Verschaeve L
C. Mutat Res 393(1-2):151-156, 1997

[Y] **Dielectric properties of human red blood cells in suspension at radio frequencies.** VIEW
Lu Y, Yu J, Ren Y
Bioelectromagnetics 15(6):589-591, 1994

[Y] **DNA analysis of retroposon-like genetic LINE elements in blood plasma of rats exposed to radio-diapason electromagnetic waves** VIEW
Belokhvostov AS, Osipovich VK, Veselova OM, Kolodiazhnaia VA.
Radiats Biol Radioecol 35(3):356-363, 1995

[Y] **DNA damage in Molt-4 T- lymphoblastoid cells exposed to cellular telephone radiofrequency fields in vitro** VIEW
Phillips JL, Ivaschuk O, Ishida-Jones T, Jones RA, Campbell-Beachler M, Haggren W
Bioelectrochem. Bioenerg. 45:103-110, 1998

[Y] **DNA damage in Molt-4 T-lymphoblastoid cells exposed to cellular telephone RFs In Vitro.** VIEW
Phillips JL, Ivaschuk O, Oshida-Jones T, Jones RA, Campbell-Beacler M, Haggren W
Bioelectrochemistry and Bioenergetics 45:103-110 1998

[Y] **Dual effects of microwaves on single Ca(2+)-activated K+ channels in cultured kidney cells** VIEW
Geletyuk VI, Kazachenko VN, Chemeris NK, Fesenko EE,
FEBS Lett 359(1):85-88, 1995

[Y] **Effect of 2.45 GHz microwave radiation on permeability of unilamellar liposomes to 5(6)-carboxyfluorescein** VIEW
Saalman E, Norden B, Arvidsson L, Hamnerius Y, Hojevik P, Connell KE, Kurucsev T,
Biochim Biophys Acta 1064(1):124-130, 1991

[Y] **Effect of electromagnetic field exposure on chemically induced differentiation of friend erythroleukemia cells** VIEW
Chen G, Upham BL, Sun W, Chang CC, Rothwell EJ, Chen KM, Yamasaki H, Trosko JE
Environ Health Perspect 2000 Oct;108(10):967-72 2000 **NOTE: 50/60 Hz study**

[Y] **Effect of EMF exposure on chemically induced differentiation of Friend erythroleukemia cells** VIEW
Chen G, Upham BL, Sun W, Chang CC,Rothwell EJ, Chen KM, Yamasaki H, Trosko JE
Environmental Health Perspectives Volume 108, Number 10, October 2000

[Y] **Effect of EMF on the activity of superoxide dismutase (SOD-1) and the level of malonyldialdehyde (MDA)** VIEW
Stopczyk D, Gnitecki W, Buczynski A, Markuszewski L, Buczynski J
Med Pr. 53(4):311-314, 2002

[Y] **Effect of isothermal radiofrequency radiation on cytolytic T lymphocytes.** VIEW
Cleary SF, Du Z, Cao G, Liu LM, McCrady C,
FASEB J 10(8):913-919. 1996

[Y] **Effect of low intensity pulse-modulated electromagnetic radiation on activity of alkaline phosphatase in blood serum** VIEW
Pashovkina MS, Akoev IG.
Radiats Biol Radioecol 41(1):62-66, 2001

[Y] **Effect of low-intensity pulse-modulated microwave on human blood aspartate aminotransferase activity** VIEW
Pashovkina MS, Akoev IG
Radiats Biol Radioecol 41(1):59-61, 2001

[Y] **Effect of microwave radiation on Candida albicans** VIEW
Rosaspina S, Salvatorelli G, Anzanel D, Bovolenta R,
Microbios 78(314):55-59, 1994

[Y] **Effect of vitamin E on morphological variation of retinal ganglion cells after microwave radiation** VIEW
Yang R, Chen J, Deng Z, Liu X,
Wei Sheng Yan Jiu 30(1):31-33, 2001

[Y] **Effects of 2,450 MHz microwave on DNA damage induced by three chemical mutagens in vitro** VIEW
Zhang MB, Jin LF, He JL, Hu J, Zheng W.
Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi. 21(4):266-269, 2003

[Y] **Effects of 2375 MHz pulse-modulated microwave radiation on ATPase activity of the rat muscle actomyosin.** VIEW
Pashovskina MS, Akoev IG
Radiats Biol Radioecol 36(5):700-705, 1996

[Y] **Effects of 2450 MHz EMF with a wide range of SARs on methylcholanthrene-induced transformation in C3H10T1/2 cells** VIEW
Wang J, Sakurai T, Koyama S, Komatubara Y, Suzuki Y, Taki M, Miyakoshi J.
J Radiat Res (Tokyo). 46(3):351-361, 2005

[Y] **Effects of co-exposure to ELF magnetic fields and benzene or benzene metabolites determined in vitro by the alkaline comet assay** VIEW
Morettia M, Villarinia, Simonuccib S, Fatigonia C, Scassellati-Sforzolinia G, Monarcaa S, Pasquinia R, Angeluccic M, Strappinic M
Elsevier Ireland Ltd 21 January 2005 **NOTE: 50/60 Hz study**

[Y] **Effects of continuous and pulsed 2450-MHz radiation on spontaneous lymphoblastoid transformation of human lymphocytes in vitro.** VIEW
Czerska EM, Elson EC, Davis CC, Swicord ML, Czerski P
Bioelectromagnetics 13(4):247-259, 1992

[Y] **Effects of electromagnetic radiation on embryos of sea-urchins.** VIEW
Koldayev VM, Shchepin YV,
Bioelectrochem Bioenerg 43:161-164, 1997

[Y] **Effects of exposure to EMR at 835 MHz on growth, morphology and secretory characteristics of a mast cell analogue, RBL-2H3** VIEW
Donnellan M, McKenzie DR, French PW
Cell Biol Int 21:427-439, 1997

[Y] **Effects of low intensity radiofrequency electromagnetic fields on electrical activity in rat hippocampal slices** VIEW
Tattersall JE, Scott IR, Wood SJ, Nettell JJ, Bevir MK, Wang Z, Somasiri NP, Chen X.
Brain Res 904(1):43-53, 2001

[Y] **Effects of low-intensity extremely high frequency electromagnetic radiation on chromatin structure of lymphoid cells in vivo and in vitro** VIEW
Gapeev AB, Lushnikov KV, Shumilina IuV, Sirota NP, Sadovnikov VB, Chemeris NK.
Radiats Biol Radioecol. 43(1):87-92, 2003

[Y] **Effects of microwaves on membranes of hematopoietic cells in their structural and functional organization** VIEW
Rotkovska D, Bartonickova A, Kautska J,
Bioelectromagnetics 14(1):79-85, 1993

[Y] **Effects of modulated and continuous microwave irradiation on pyroantimonate precipitable calcium content in junctional complex of mouse small intestine.** VIEW
Somosy Z, Thuroczy G, Kovacs J
Scanning Microsc 7(4):1255-1261, 1993

[Y] **Effects of modulated and continuous microwave irradiation on the morphology and cell surface negative charge of 3T3 fibroblasts.** VIEW
Somosy Z, Thuroczy G, Kubasova T, Kovacs J, Szabo LD
Scanning Microsc 5(4):1145-1155, 1991

[Y] **Effects of modulated microwave and X-ray irradiation on the activity and distribution of Ca^{++}-ATPase in small intestine epithelial cells** VIEW
Somosy Z, Thuroczy G, Koteles GJ, Kovacs J,
Scanning Microsc 8(3):613-619; discussion 619-620, 1994

[Y] **Effects on protein kinase C and gene expression in a human mast cell line, HMC-1, following microwave exposure.** VIEW
Harvey C, French PW
Cell Biol Int 23(11):739-748, 2000

[Y] **Electromagnetic fields (1.75 GHz) influence the permeability of the blood-brain barrier in cell culture model.** VIEW
Schirmacher A, Bahr A, Kullnick U, Stoegbauer F
Presented at the Twentieth Annual Meeting of the Bioelectromagnetics Society, St. Pete Beach, FL, June 1998

[Y] **Electromagnetic fields (1.8 GHz) increase the permeability to sucrose of The blood-brain barrier in vitro.** VIEW
Schirmacher A, Winters S, Fischer S, Goeke J, Galla H, Kullnick U, Ringelstein EB, Stogbauer F,
Bioelectromagnetics 21(5):338-345, 2000

[Y] **Electromagnetic fields at mobile phone frequency induce apoptosis and inactivation of the multi-chaperone complex in human epidermoid cancer cells.** VIEW
Caraglia M, Marra M, Mancinelli F, D'Ambrosio G, Massa R, Giordano A, Budillon A, Abbruzzese A, Bismuto E.
J Cell Physiol. 204(2):539-548, 2005

[Y] **Electromagnetic radiation at 835 MHz changes the morphology and inhibits proliferation of a human astrocytoma cell line.** VIEW
French PW, Donnellan M, McKenzie DR
Bioelectrochem Bioenerg 43:13-18, 1997

[Y] **Environmental-health aspects of pulse-modulated microwaves** VIEW
Neshev NN, Kirilova EI
Rev Environ Health 11(1-2):85-88, 1996

[Y] **Ets1 oncogene induction by ELF-modulated 50 MHz RF electromagnetic field.** VIEW
Romano-Spica V, Mucci N, Ursini CL, Ianni A, Bhat NK
Bioelectromagnetics 21(1):8-18, 2000

[Y] **Experimental study and mechanism analysis on bioeffects by nanosecond electromagnetic pulses.** VIEW
Wang BY, Yang JB, Guo QG, Xu RM, Liu CJ, Zhang H, Zou FD, Wang ZS
Science in China (Series C) 40:301-304, 1997

[Y] **Exposure of frog hearts to CW or amplitude-modulated VHF fields: selective efflux of calcium ions at 16 Hz.** VIEW
Schwartz JL, House DE, Mealing GA,
Bioelectromagnetics 11(4):349-358, 1990

[Y] **Exposure of nerve growth factor treated PC12 rat phenochromocytoma cells to a modulated RF field at 836.55 MHz.** VIEW
Ivaschuk OI, Ishida-Jones T, Adey WR, Phillips JL
Bioelectromagnetics 18: 223-229 1997

[Y] **Exposure of nerve growth factor-treated PC12 rat pheochromocytoma cells to a modulated radiofrequency field at 836.55 MHz: effects on c-jun and c-fos expression.** VIEW
Ivaschuk OI, Jones RA, Ishida-Jones T, Haggren W, Adey WR, Phillips JL,
Bioelectromagnetics 18(3):223-229, 1997

[Y] **Exposure of the Dorsal Root Ganglion in Rats to Pulsed Radiofrequency Currents Activates Dorsal Horn Lamina I and II Neurons.** VIEW
Higuchi Y, Nashold BS Jr, Sluijter M, Cosman E, Pearlstein RD.
Neurosurgery 50(4):850-856, 2002

[Y] **Exposure to GSM alters gene expression, proliferation, and morphology of human skin fibroblasts.** VIEW
Pacini S, Ruggiero M, Sardi I, Aterini S, Gulisano F, Gulisano M.
Oncol Res 13(1):19-24, 2002

[Y] **Expression of proto-oncogene and activities of multiple transcription factors in RF exposed cells, using C3H10T1/2 mouse embryo fibroblast cells exposed to 835.62 and 847.74 MHz cellphone radiations.** VIEW
Goswami PC, Albee LD, Parsian AJ, Baty JD, Moros EG, Pickard WF, Roti-Roti JL, Hunt CR,
Presented at the 1997 Muchaelson Conference. Radiat Res 151(3):300-309, 1999

[Y] **Extracellular calcium and microwave enhancement of membrane conductance in snail neurons** VIEW
Arber SL, Lin JC
Radiat Environ Biophys. 1985;24(2):149-56. 1985

[Y] **Extremely high frequency EMFs at low power density do not affect the division of exponential phase Saccharomyces cerevisiae cells.** VIEW
Gos P, Eicher B, Kohli J, Heyer WD
Bioelectromagnetics 18(2):142-155, 1997

[Y] **F absorption involving biological macromolecules.** VIEW
Prohofsky EW.
Bioelectromagnetics. 25(6):441-451, 2004

[Y] **Free Radical Release and HSP70 Expression in Two Human Immune-Relevant Cell Lines after Exposure to 1800 MHz RFR.** VIEW
Lantow M, Schuderer J, Hartwig C, Simko M.
Radiat Res. 165(1):88-94, 2006

[Y] **Frequency-dependent alterations in enolase activity in Escherichia coli caused by exposure to electric and magnetic fields.** VIEW
Dutta SK, Verma M, Blackman CF,
Bioelectromagnetics 15(5):377-383, 1994

[Y] **Further (Final?) studies to find DNA damage due to exposure to RF and microwave radiation.** VIEW
Roti-Roti J, LaGroye I, Li L, Zhang P, Sisht K, Straube WL, Moros EG, Pickard WF
Presented at Michaelson Conference in Cloucroft, New Mexico 1999

[Y] **Genotoxicity of radiofrequency signals. I. Investigation of DNA damage and micronuclei induction in cultured human blood cells.** VIEW
Tice RR , Hook GG , Donner M , McRee DI, Guy AW
Bioelectromagnetics 23:113-126, 2002

[Y] **Genotoxicity of RF fields generated from analog, TDMA, CDMA and PCS technology evaluated using a single-cell gell electrophoresis and the Cytochalasin B micronucleus (CB-MN) assay** VIEW
Hook GJ, Vasquez M, Blackwell DM, Clancy JJ, Donner EM, Tice RR, McRee D
Presented at BEMS in Long Beach, California 1999

[Y] **High frequency electromagnetic fields (GSM signals) affect gene expression levels in tumor suppressor p53-deficient embryonic stem cells.** VIEW
Czyz J , Guan K, Zeng Q, Nikolova T, Meister A, Schönborn F, Schuderer J, Kuster N, Wobus AM
Bioelectromagnetics 25:296-307, 2004

[Y] **Immunotropic Effects in Cultured Human Blood Mononuclear Cells** VIEW
Dabrowski MP, Stankiewicz W, Kubacki R, Sobiczewska E, Szmigielski S.
Electromag. Biol. Med. 22:1-13, 2003

[Y] **In vitro cytogenetic effects of 2450 MHz waves on human peripheral blood lymphocytes.** VIEW
Maes A, Verschaeve L, Arroyo A, De Wagter C, Vercruyssen L,
Bioelectromagnetics 14(6):495-501, 1993

[Y] **In vitro exposure of human lymphocytes to 900 MHz CW and GSM** VIEW
Capri M, Scarcella E, Fumelli C, Bianchi E, Salvioli S, Mesirca P, Agostini C, Antolini A, Schiavoni A, Castellani G, Bersani F, Franceschi C
Radiat Res. 162(2):211-218, 2004

[Y] **In vitro microwave effects on human neutrophil precursor cells (CFU-C)** VIEW
Ottenbreit MJ, Lin JC, Inoue S, Peterson WD Jr
Bioelectromagnetics. ;2(3):203-15. 1981

[Y] **Individual responsiveness to induction of micronuclei in human lymphocytes after exposure in vitro to 1800-MHz microwave radiation.** VIEW
Zotti-Martelli L, Peccatori M, Maggini V, Ballardin M, Barale R.
Mutat Res. 582(1-2):42-52, 2005

[Y] **Induction of micronuclei in human lymphocytes exposed in vitro to microwave radiation.** VIEW
Zotti-Martelli L, Peccatori M, Scarpato R, Migliore L,
Mutat Res 472(1-2):51-58, 2000

[Y] **Influence of microwaves on different types of receptors and the role of peroxidation of lipids on receptor-protein shedding.** VIEW
Philippova TM, Novoselov VI, Alekseev SI,
Bioelectromagnetics 15(3):183-192, 1994

[Y] **Inter-beat intervals of cardiac-cell aggregates during exposure to 2.45 GHz CW, pulsed, and square-wave-modulated microwaves** VIEW
Seaman RL, DeHaan RL,
Bioelectromagnetics 14(1):41-55, 1993

[Y] **Investigation of the genotoxic effect of microwave irradiation in rat bone marrow cells: in vivo exposure.** VIEW
Trosic I, Busljeta I, Modlic B
Mutagenesis. 19(5):361-364, 2004

[Y] **IRIDIUM exposure increases c-fos expression in the mouse brain only at levels which likely result in tissue heating.** VIEW
Morrissey JJ, Raney S, Heasley E, Rathinavelu P, Dauphinee M, Fallon JH,
Neuroscience 92(4):1539-1546, 1999

[Y] **Localized effects of microwave radiation on the intact eye lens in culture conditions** VIEW
Dovrat A, Berenson R, Bormusov E, Lahav A, Lustman T, Sharon N, Schachter L
Bioelectromagnetics. May 10 2005

[Y] **Long-lasting (fatiguing) activity of isolated muscle fibres influenced by microwave electromagnetic field.** VIEW
Radicheva N, Mileva K, Georgieva B, Kristev I
Acta Physiol Pharmacol Bulg 26(1-2):37-40, 2001

[Y] **Low power microwave radiation inhibits the proliferation of rabbit lens epithelial cells by upregulating P27Kip1 expression.** VIEW
Yao K, Wang KJ, Sun ZH, Tan J, Xu W, Zhu LJ, Lu de Q.
Mol Vis. 10:138-143, 2004

[Y] **Membrane electroporation due to weak transient electromagnetic pulses** VIEW
Wang BY, Liu CJ, Zhang H, Wang ZS
Proceedings of The 4th Asia-Pacific Conference on Medical and Biomedical Engineering, Seoul, Korea, P. 31, 1999

[Y] **Microwave and ELF electromagnetic field effects on intercellular communication** VIEW
Chiang H,
Proceedings of the 20th Annual International Conference of the IEEE Engineering in Medicine and Biology Society 20:2798-2801, 1998

[Y] **Microwave effects on input resistance and action potential firing of snail neurons** VIEW
Ginsburg KS, Lin JC, O'Neill WD
IEEE Trans Biomed Eng. 39(10):1011-1021, 1992

[Y] **Microwave enhanced kinetics observed in ORD studies of a protein.** VIEW
Bohr H, Bohr J,
Bioelectromagnetics 21(1):68-72, 2000

[Y] **Microwave enhancement of membrane conductance in snail neurons: role of temperature.** VIEW
Arber SL, Lin JC
Physiol Chem Phys Med NMR. 15(3):259-60. 1983

[Y] **Microwave enhancement of membrane conductance: effects of EDTA, caffeine and tetracaine** VIEW

Arber SL, Lin JC
Physiol Chem Phys Med NMR. 1984;16(6):469-75. 1984

[Y] **Microwave exposure alters the expression of 2-5A-dependent RNase** VIEW
Krause D, Mullins JM, Penafiel LM, Meister R, Nardone RM,
Radiat Res 127(2):164-170, 1991

[Y] **Microwave exposure induces Hsp70 and confers protection against hypoxia in chick embryos** VIEW
Shallom JM, Di Carlo AL, Ko D, Penafiel LM, Nakai A, Litovitz TA
J Cell Biochem 86(3):490-496, 2002

[Y] **Microwave influence on the isolated heart function: I. Effect of modulation** VIEW
Pakhomov AG, Dubovick BV, Degtyariov IG, Pronkevich AN,
Bioelectromagnetics 16(4):241-249, 1995

[Y] **Microwave influence on the isolated heart function: II. Combined effect of radiation and some drugs.** VIEW
Pakhomov AG, Dubovick BV, Degtyariov IG, Pronkevich AN,
Bioelectromagnetics 16(4):250-254, 1995

[Y] **Microwave irradiation influences on the state of human cell nuclei** VIEW
Shckorbatov YG, Grigoryeva NN, Shakhbazov VG, Grabina VA, Bogoslavsky AM,
Bioelectromagnetics 19(7):414-419, 1998

[Y] **Microwave radiation can alter protein conformation without bulk heating** VIEW
de Pomerai DI, Smith B, Dawe A, North K, Smith T, Archer DB, Duce IR, Jones D, Candido EP
FEBS Lett 22;543(1-3):93-97, 2003

[Y] **Microwave-induced changes in nerve cells: effects of modulation and temperature.** VIEW
Arber SL, Lin JC
Bioelectromagnetics. 1985;6(3):257-70 1985

[Y] **Microwaves from GSM Mobile Telephones Affect 53BP1 and gamma-H2AX Foci in Human Lymphocytes from Hypersensitive and Healthy Persons** VIEW
Markova E, Hillert L, Malmgren L, Persson BR, Belyaev IY
Environ Health Perspect. 113(9):1172-1177, 2005

[Y] **Millemetre waves inhibit the synergistic effect of calcium ionophore A23187 and phorbol ester in neutrophil respiratory burst** VIEW
Safronova VG, Gapeev AB, Alovskaia AA, Gabdulkhakova AG, Chemeris NK, Fesenko EE
Biofizika 42(6): 1267-1273, 1997

[Y] **Millimeter-wave effects on electric activity of crayfish stretch receptors** VIEW
Khramov RN, Sosunov EA, Koltun SV, Ilyasova EN, Lednev VV,
Bioelectromagnetics 12(4):203-214, 1991

[Y] **Modification of membrane fluidity in melanin-containing cells by low-level microwave radiation.** VIEW
Phelan AM, Lange DG, Kues HA, Lutty GA,
Bioelectromagnetics 13(2):131-146, 1992

[Y] **Modification of the activity of murine peritoneal neutrophils upon exposure to millimeter waves at close and far distances from the emitter** VIEW
Gapeev AB, Safronova VG, Chemeris NK, Fesenko EE,
Biofizika 41(1): 205-219, 1996

[Y] **Modulated extremely high frequency EMR of low intensity activates or inhibits respiratory burst in neutrophils depending on modulation frequency** VIEW
Gapeev AB, Iakushina VS, Chemeris NK, Fesenko EE,
Biofizika 42(5): 1125-1134, 1997

[Y] **Neoplastic transformation of C3H/10T1/2 cells following exposure to 120-Hz modulated 2.45-GHz microwaves and phorbol ester tumor promoter** VIEW
Balcer-Kubiczek EK, Harrison GH
Radiat Res 126(1):65-72, 1991

[Y] **NF- B DNA-binding activity after high peak power pulsed microwave (8.2 GHz) exposure of normal human monocytes.** VIEW
Natarajan M, Vijayalaxmi , Szilagyi M, Roldan FN, Meltz ML.
Bioelectromagnetics 23:271-277, 2002

[Y] **Noise-modulated-microwave-induced response in snail neurons.** VIEW
Lin JC, Arber SL
Physiol Chem Phys Med NMR. 15(3):261-3 1983

[Y] **Non-thermal DNA breakage by mobile-phone radiation (1800MHz) in human fibroblasts** VIEW
Diem E, Schwarz C, Adlkofer F, Jahn O, Rudiger H.
Mutat Res. Apr 30 2005

[Y] **Non-thermal effects of continuous 2.45 GHz microwaves on Fas-induced apoptosis in human Jurkat T-cell line.** VIEW
Peinnequin A, Piriou A, Mathieu J, Dabouis V, Sebbah C, Malabiau R, Debouzy JC
Bioelectrochemistry 51(2):157-161, 2000

[Y] **Non-thermal microwave effect on nerve fiber function** VIEW
Pakhomov AG,
Biofizika 38(2):367-371, 1993

[Y] **Ouabain inhibition of kidney ATPase is altered by 9.14 GHz radiation.** VIEW
Brown HD, Chattopadhyay SK,
Bioelectromagnetics 12(3):137-143, 1991

[Y] **Preliminary evaluation of nanoscale biogenic magnetite-based ferromagnetic transduction mechanisms for mobile phone bioeffects.** VIEW
Cranfield C, Wieser HG, Al Madan J, Dobson J
IEEE Trans Nanobioscience. 2(1):40-43, 2003

[Y] **Proteomics analysis of human endothelial cell line EA.hy926 after exposure to GSM 900 radiation.** VIEW
Nylund R, Leszczynski D
Proteomics 4:1359-1365, 2004

[Y] **Proto-oncogene mRNA levels and activities of multiple transcription factors in C3H 10T 1/2 murine embryonic fibroblasts exposed to 835.62 and 847.74 MHz cellular phone communication frequency radiation.** VIEW
Goswami PC, Albee LD, Parsian AJ, Baty JD, Moros EG, Pickard WF, Roti Roti JL, Hunt CR,
Radiat Res 151(3):300-309, 1999

[Y] **Pulsed radiofrequency applied to dorsal root ganglia causes a selective increase in ATF3 in small neurons.** VIEW
Hamann W, Abou-Sherif S, Thompson S, Hall S.
Eur J Pain. 10(2):171-176, 2006

[Y] **Radiofrequency electromagnetic fields and cell proliferation.** VIEW
Kwee S, Raskmark P
Presented at the Second World Congress for Electricity and Magnetism in Biology and Medicine, Bologna, Italy, June, 1997

[Y] **Resonance effect of microwaves on the genome conformational state of E. coli cells.** VIEW
Belyaev IYa, Alipov YD, Shcheglov VS, Lystsov VN
Z Naturforsch [C] 47(7-8):621-827, 1992

[Y] **Resonance effect of millimeter waves in the power range from $10^{(-19)}$ to 3 x $10^{(-3)}$ W/cm^2 on E-coli cells at different concentrations.** VIEW
Belyaev IY, Shcheglov VS, Alipov YD, Polunin VA,
Bioelectromagnetics 17(4):312-321, 1996

[Y] **Reverse-micelle model: pH, electromagnetic field and inhibitor enzyme interaction.** VIEW
Chattopadhyay SK, Toews KA, Butt S, Barlett R, Brown HD
Cancer Biochem Biophys 15:245-255, 1997

[Y] **Role of modulation on the effect of microwaves on ornithine decarboxylase activity in L929 cells** VIEW
Penafiel LM, Litovitz T, Krause D, Desta A, Mullins JM
Bioelectromagnetics 18(2):132-141, 1997

[Y] **Single- and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation** VIEW
Lai H, Singh NP
Int J Radiat Biol 69(4):513-521, 1996

[Y] **Single- and double-strand DNA breaks in rat brain cells after acute exposure to radiofrequency electromagnetic radiation.** VIEW
Lai H, Singh NP
Int-J-Radiat-Biol. 1996 Apr. 69(4). P 513-21. 1996

[Y] **Stimulation of murine natural killer cells by weak electromagnetic waves in the centimeter range** VIEW
Fesenko EE, Novoselova EG, Semiletova NV, Agafonova TA, Sadovnikov VB,
Biofizika 44(4):737-741, 1999

[Y] **Studying the synergistic damage effects induced by 1.8GHz RFR with four chemical mutagens on human lymphocyte DNA** VIEW
Baohong W, Jiliang H, Lifen J, Deqiang L, Wei Z, Jianlin L, Hongping D.
Mutat Res. May 31; 2005

[Y] **Tandem repeat sequences as markers to study microwave-DNA interaction** VIEW

Sarkar S
Presented at the National Seminar on Low-level Electromagnetic Field Phenomena in Biological Systems New Delhi, India, February, 1999

[Y] **The correlation between the frequency of micronuclei and specific chromosome aberrations in human lymphocytes exposed to microwave radiation in vitro.** VIEW
Garaj-Vrhovac V, Fucic A, Horvat D
Mutat Res 281(3):181-186, 1992

[Y] **The effect of 2450 MHz microwave radiation on the ultrastructure of snail neurons** VIEW
Arber SL, Neilly JP, Lin JC, Kriho V.
Physiol Chem Phys Med NMR. 18(4):243-9. 1986

[Y] **The effect of 50 Hz magnetic field on GCSmRNA expression in lymphoma B cell by mRNA differential display.** VIEW
Wu RY, Chiang H, Hu GL, Zeng QL, Bao JL
J Cell Biochem Dec 1;79(3):460-470 2000 **NOTE: 50/60 Hz study**

[Y] **The effect of electromagnetic field exposure on the formation of DNA lesions.** VIEW
Lourencini da Silva R , Albano F, Lopes dos Santos LR , Tavares AD, Felzenszwalb I,
Redox Rep 5(5):299-301, 2000

[Y] **The effect of electromagnetic waves on the growth of Entamoeba histolytica and Entamoeba dispar.** VIEW
Aksoy U, Sahin S, Ozkoc S, Ergor G
Saudi Med J. 26(9):1388-1390, 2005

[Y] **The effect of microwave radiation on the stability and formation of gramicidin-A channels in lipid bilayer membranes.** VIEW
Sandblom J, Theander S,
Bioelectromagnetics 12(1):9-20, 1991

[Y] **The effect of pulsed microwaves on passive electrical properties and interspike intervals of snail neurons.** VIEW
Field AS, Ginsburg K, Lin JC
Bioelectromagnetics 14(6):503-520, 1993

[Y] **The effect of pulsed microwaves on passive electrical properties and interspike intervals of snail neurons.** VIEW
Field AS, Ginsburg K, Lin JC
Bioelectromagnetics. 14(6):503-520, 1993

[Y] **The effect of ultrahigh-frequency radiation on adaptation thresholds and the damages to blood system cells** VIEW
Obukhan KI
Lik Sprava (7):71-73, 1998

[Y] **The effects of radiofrequency fields on cell proliferation are non-thermal.** VIEW
Velizarov S, Raskmark P, Kwee S
Bioelectrochem Bioenerg 48(1):177-180, 1999

[Y] **The effects of radiofrequency radiation on long term potentiation in rat hippocampal slices.** VIEW
Scott IR, Tattersall JEH
Presented at theTwenty-first Annual Meeting of the Bioelectromagnetics Society, Long Beach, CA, June 1999

[Y] **The microarray study on the stress gene transcription profile in human retina pigment epithelial cells exposed to microwave radiation.** VIEW
iu X, Shen H, Shi Y, Chen J, Chen Y, Ji A
Zhonghua Yu Fang Yi Xue Za Zhi 36(5):291-294, 2002

[Y] **The role of coherence time in the effect of microwaves on ornithine decarboxylase activity.** VIEW
Litovitz TA, Krause D, Penafiel M, Elson EC, Mullins JM,
Bioelectromagnetics 14(5):395-403, 1993

[Y] **X-rays, microwaves and vinyl chloride monomer: their clastogenic and aneugenic activity, using the micronucleus assay on human lymphocytes.** VIEW
Fucic A, Garaj-Vrhovac V, Skara M, Dimitrovic B,
Mutat Res 282(4):265-271, 1992

IN UTERO (28)

[N] **Do Cellular Phones alter Blood Parameters and Birth Weights of Rats?** VIEW
Dasdag S; Akdag MZ; Ayy ld z O, Demirtas OC, Yayla M, Sert C.
Electromag. Biol. Med. 19:107-113, 2000

[N] **Prenatal exposure to 900 MHz, cell-phone electromagnetic fields had no effect on operant-behavior performances of adult rats.** VIEW
Bornhausen M, Scheingraber H,
Bioelectromagnetics 21(8):566-574, 2000

[N] **The lack of effects of nonthermal RF electromagnetic fields on the development of rat embryos** VIEW
Klug S, Hetscher M, Giles S, Kohlsmann S, Kramer K
Life Sci 61(18):1789-1802, 1997

[N] **Thermal and metabolic responsiveness of Japanese quail embryos following periodic exposure to 2,450 MHz microwaves.** VIEW
Spiers DE, Baummer SC,
Bioelectromagnetics 12(4):225-239, 1991

[N] **Two-year chronic bioassay study of rats exposed to a 1.6 GHz radiofrequency signal.** VIEW
Anderson LE, Sheen DM, Wilson BW, Grumbein SL, Creim JA, Sasser LB.
Radiat Res. 162(2):201-210, 2004

[Y] **Behavioral teratologic studies using microwave radiation: is there an increased risk from exposure to cellular phones and microwave ovens?** VIEW
Jensh RP,
Reprod Toxicol 11(4):601-611, 1997

[Y] **Biological effects of mobile phone electromagnetic field on chick embryo (risk assessment using the mortality rate)** VIEW
Grigor'ev IuG
Radiats Biol Radioecol. 43(5):541-543, 2003

[Y] **Bone morphogenetic protein expression in newborn rat kidneys after prenatal exposure to radiofrequency radiation.** VIEW
Pyrpasopoulou A, Kotoula V, Cheva A, Hytiroglou P, Nikolakaki E, Magras IN, Xenos TD, Tsiboukis TD, Karkavelas G
Bioelectromagnetics 25(3):216-227, 2004

[Y] **Chronic electromagnetic field exposure decreases HSP70 levels and lowers cytoprotection.** VIEW
Di Carlo A, White N, Guo F, Garrett P, Litovitz T.
J. Cell. Biochem. 84: 447-454, 2002

[Y] **Developmental toxicity interactions of methanol and radiofrequency radiation or 2-methoxyethanol in rats.** VIEW
Nelson BK, Snyder DL, Shaw PB,
Int J Toxicol 20(2):89-100, 2001

[Y] **Developmental toxicity interactions of salicylic acid and radiofrequency radiation or 2-methoxyethanol in rats.** VIEW
Nelson BK, Snyder DL, Shaw PB
Reprod Toxicol 13(2):137-145, 1999

[Y] **Effect of continuous-wave and amplitude-modulated 2.45 GHz microwave radiation on the liver and brain aminoacyl-transfer RNA synthetases of in utero exposed mice.** VIEW
Kubinyi G, Thuroczy G, Bakos J, Boloni E, Sinay H, Szabo LD,
Bioelectromagnetics 17(6):497-503, 1996

[Y] **Effect of environmental temperature on the interactive developmental toxicity of radiofrequency radiation and 2-methoxyethanol in rats.** VIEW
Nelson BK, Conover DL, Krieg EF Jr, Snyder DL, Edwards RM
Int Arch Occup Environ Health 71(6):413-423, 1998

[Y] **Effect of millimeter waves on the early development of the mouse and sea urchin embryo** VIEW
Galat VV, Mezhevikina LM, Zubin MN, Lepikhov KA, Khramov RN, Chailakhian LM,
Biofizika 44(1):137-140, 1999

[Y] **Effects of 2.45-GHz electromagnetic fields with a wide range of SARs on micronucleus formation in CHO-K1 cells.** VIEW
Koyama S, Isozumi Y, Suzuki Y, Taki M, Miyakoshi J.
ScientificWorldJournal 4 Suppl 2:29-40, 2004

[Y] **Effects of exposure to microwaves on cellular immunity and placental steroids in pregnant rats.** VIEW
Nakamura H, Seto T, Nagase H, Yoshida M, Dan S, Ogino K,
Occup Environ Med 54(9):676-680, 1997

[Y] **Effects of exposure to microwaves on cellular immunity and placental steroids in pregnant rats.** VIEW
Nakamura H, Seto T, Yoshida M, Dan S, Ogino K, Nagase H
Occup Environ Med 54(9):676-80, 1997

[Y] **Effects of hyperthermia induced by microwave irradiation on brain development in mice** VIEW
Fukui Y, Hoshino K, Inouye M, Kameyama Y
J Radiat Res (Tokyo) 33(1):1-10, 1992

[Y] **Endocrine mechanism of placental circulatory disturbances induced by microwave in pregnant rats** VIEW
Yoshida Y, Seto T, Ohsu W, Hayashi S, Okazawa T, Nagase H, Yoshida M, Nakamura H
Nippon Sanka Fujinka Gakkai Zasshi 47(2):101-108, 1995

[Y] **Fetal rat brain ornithine decarboxylase (ODC) activity and polyamine levels following exposures to Iridium cell phone fields in late pregnancy** VIEW
Adey WR,
Unpublished but presented at a workshop in Washington, D.C. on Feb 4 2000

[Y] **Interactions of radiofrequency radiation on 2-methoxyethanol teratogenicity in rats.** VIEW
Nelson BK, Conover DL, Shaw PB, Snyder DL, Edwards RM
J Appl Toxicol 17(1):31-39, 1997

[Y] **Interactions of RF radiation-induced hyperthermia and 2-methoxyethanol teratogenicity in rats.** VIEW
Nelson BK, Conover DL, Krieg EF Jr, Snyder DL, Edwards RM
Bioelectromagnetics;18(5):349-359, 1997

[Y] **Interactive developmental toxicity of radiofrequency radiation and 2-methoxyethanol in rats.** VIEW
Nelson BK, Conover DL, Shaw PB, Werren DM, Edwards RM, Hoberman AM,
Teratology 50(4):275-293, 1994

[Y] **Marked increase in the teratogenicity of the combined administration of the industrial solvent 2-methoxyethanol and radiofrequency radiation in rats.** VIEW
Nelson BK, Conover DL, Brightwell WS, Shaw PB, Werren D, Edwards RM, Lary JM,
Teratology 43(6):621-634, 1991

[Y] **Natural killer cell activity reduced by microwave exposure during pregnancy is mediated by opioid systems.** VIEW
Nakamura H, Seto T, Hatta K, Matsuzaki I, Nagase H, Yoshida M, Ogino K
Environ Res 79(2):106-13, 1998

[Y] **Neural and behavioral teratological evaluation of rats exposed to ultra-wideband electromagnetic fields.** VIEW
Cobb BL, Jauchem JR, Mason PA, Dooley MP, Miller SA, Ziriax JM, Murphy MR,
Bioelectromagnetics 21(7):524-537, 2000

[Y] **RF radiation-induced changes in the prenatal development of mice.** VIEW
Magras IN, Xenos TD
Bioelectromagnetics 18(6):455-461, 1997

[Y] **Uteroplacental circulatory disturbance mediated by prostaglandin f(2alpha) in rats exposed to microwaves*** VIEW
Nakamura H, Nagase H, Ogino K, Hatta K, Matsuzaki I,
Reprod Toxicol 14(3):235-40, 2000

HUMAN (126)

[N] **902 MHz mobile phone does not affect short term memory in humans.** VIEW
Haarala C, Ek M, Bjornberg L, Laine M, Revonsuo A, Koivisto M, Hamalainen H
Bioelectromagnetics. 25(6):452-456, 2004

[N] **902 MHz mobile phone does not affect short term memory in humans** VIEW
Haarala C, Ek M, Bjornberg L, Laine M, Revonsuo A, Koivisto M, Hamalainen H.
Bioelectromagnetics. 25(6):452-456, 2004

[N] **Acute effects of using a mobile phone on CNS functions.** VIEW
Hladky A, Musil J, Roth Z, Urban P, Blazkova V
Cent Eur J Public Health 7(4):165-167. 1999

[N] **Analysis of auditory evoked potential parameters in the presence of radiofrequency fields using a support vector machines method.** VIEW
Maby E, Le Bouquin Jeannes R, Liegeois-Chauvel C, Gourevitch B, Faucon G
Med Biol Eng Comput. 42(4):562-568, 2004

[N] **Assessment of potential effects of the electromagnetic fields of mobile phones on hearing. BMC Public Health.** VIEW
Uloziene I, Uloza V, Gradauskiene E, Saferis V.
BMC Public Health. 5(1):39, 2005

[N] **Can electromagnetic fields emitted by mobile phones stimulate the vestibular organ?** VIEW
Pau HW, Sievert U, Eggert S, Wild W.
Otolaryngol Head Neck Surg. 132(1):43-49, 2005

[N] **Can mobile phone emissions affect auditory functions of cochlea or brain stem?** VIEW
Sievert U, Eggert S, Pau HW.
Otolaryngol Head Neck Surg. 132(3):451-455, 2005

[N] **Does acute exposure to mobile phones affect human attention?** VIEW
Russo R, Fox E, Cinel C, Boldini A, Defeyter MA, Mirshekar-Syahkal D, Mehta A
Bioelectromagnetics. Nov 22; 2005

[N] **Does acute exposure to the electromagnetic field emitted by a mobile phone influence visual evoked potentials? A pilot study.** VIEW
Urban P, Lukas E, Roth Z
Cent Eur J Public Health 6(4):288-290, 1998

[N] **Effect of a 902 MHz electromagnetic field emitted by mobile phones on human cognitive function: A replication study.** VIEW
Haarala C, Bjornberg L, Ek M, Laine M, Revonsuo A, Koivisto M, Hamalainen H
Bioelectromagnetics 24(4):283-288, 2003

[N] **Effect of electromagnetic field emitted by cellular phones on fetal heart rate patterns.** VIEW
Celik O, Hascalik S
Eur J Obstet Gynecol Reprod Biol. 112(1):55-56, 2004

[N] **Effects of pulsed high-frequency electromagnetic fields on the neuroendocrine system.** VIEW
Mann K, Wagner P, Brunn G, Hassan F, Hiemke C, Roschke J
Neuroendocrinology 67(2):139-144, 1998

[N] **Effects of the electromagnetic field of mobile telephones on hearing** VIEW
Ozturan O, Erdem T, Miman MC, Kalcioglu MT, Oncel S.
Acta Otolaryngol. 122(3):289-293, 2002

[N] **Electromagnetic field emitted by 902 MHz mobile phones shows no effects on children's cognitive function** VIEW
Haarala C, Bergman M, Laine M, Revonsuo A, Koivisto M, Hamalainen H
Bioelectromagnetics. Jul 29; 2005

[N] **GSM phone signal does not produce subjective symptoms.** VIEW
Koivisto M, Haarala C, Krause CM, Revonsuo A, Laine M, Hamalainen H,
Bioelectromagnetics 22(3):212-515, 2001

[N] **Hands-free mobile phone conversation impairs the peripheral visual system to an extent comparable to an alcohol level of 4-5 g 100 ml.** VIEW
Langer P, Holzner B, Magnet W, Kopp M
Hum Psychopharmacol. 20(1):65-66, 2005

[N] **Human brain activity during exposure to radiofrequency fields emitted by cellular phones** VIEW
Hietanen M, Kovala T, Hamalainen AM,
Scand J Work Environ Health 26(2):87-92, 2000

[N] **Human sleep EEG under the influence of pulsed radio frequency electromagnetic fields. results from polysomnographies using submaximal high power flux densities.** VIEW
Wagner P, Roschke J, Mann K, Fell J, Hiller W, Frank C, Grozinger M,
Neuropsychobiology 42(4):207-212, 2000

[N] **Human sleep under the influence of pulsed radiofrequency electromagnetic fields: a polysomnographic study using standardized conditions.** VIEW
Wagner P, Roschke J, Mann K, Hiller W, Frank C
Bioelectromagnetics 19(3):199-202, 1998

[N] **Hypersensitivity symptoms associated with exposure to cellular telephones: No causal link** VIEW
Hietanen M, Hämäläinen A-M, Husman T.
Bioelectromagnetics 23:264-270, 2002

[N] **Impact of CDMA wireless phone power output and puncture rate on hearing aid interference levels** VIEW
Fry TL, Schlegel RE, Grant H,
Biomed Instrum Technol 34(1) :29-38, 2000

[N] **Influence of a RF EMF on Cardiovascular and Hormonal Parameters of the Autonomic Nervous System.** VIEW
Braune, S., Riedel, A., Schulte-Monting, J. and Raczek, J.
Radiat. Res. 158, 352-356 2002

[N] **Influence of modulated high-frequency electromagnetic fields on the functional organization and dynamics of the common brainstem system.** VIEW
Rittweger J, Lambertz M, Kluge W, Kramer K, Langhorst P
Bioelectrochem Bioenerg 37(1):31-37, 1995

[N] **Influence on the mechanisms of generation of distortion product otoacoustic emissions of mobile phone exposure.** VIEW
Parazzini M, Bell S, Thuroczy G, Molnar F, Tognola G, Lutman ME, Ravazzani P.
Hear Res. Jul 26 2005

[N] **Investigation of potential effects of cellular phones on human auditory function by means of distortion product otoacoustic emissions.** VIEW
Janssen T, Boege P, von Mikusch-Buchberg J, Raczek J.
J Acoust Soc Am. 117(3 Pt 1):1241-1247, 2005

[N] **Is cochlear outer hair cell function affected by mobile telephone radiation?** VIEW

Monnery PM, Srouji EI, Bartlett J
Clin Otolaryngol 29(6):747-749, 2004

[N] **No effect on cognitive function from daily mobile phone use** VIEW
Besset A, Espa F, Dauvilliers Y, Billiard M, de Seze R.
Bioelectromagnetics. 26(2):102-108, 2005

[N] **No effects of pulsed high-frequency electromagnetic fields on heart rate variability during human sleep.** VIEW
Mann K, Roschke J, Connemann B, Beta H
Neuropsychobiology;38(4):251-256, 1998

[N] **No influence on selected parameters of human visual perception of 1970 MHz UMTS-like exposure.** VIEW
Schmid G, Sauter C, Stepansky R, Lobentanz IS, Zeitlhofer J
Bioelectromagnetics. 26(4):243-250, 2005

[N] **No short-term effects of digital mobile radio telephone on the awake human electroencephalogram.** VIEW
Roschke J, Mann K
Bioelectromagnetics 18(2):172-176, 1997

[N] **Occupational exposure to high frequency electromagnetic fields and its effect on human immune parameters** VIEW
Tuschl H, Neubauer G, Garn H, Duftschmid K, Winker N, Brusl H
Int J Occup Med Environ Health;12(3):239-251, 1999

[N] **The effects of radiocellular telephones on the circadian patterns of melatonin secretion, a chronobiological rhythm marker** VIEW
de Seze R, Ayoub J, Peray P, Miro L, Touitou Y,
J Pineal Res 27(4):237-242, 1999

[N] **The excretion of 6-hydroxymelatonin sulfate in healthy young men exposed to EMF.** VIEW
Bortkiewicz A, Pilacik B, Gadzicka E, Szymczak W
Neuroendocrinol Lett 23 Suppl 1:88-91, 2002

[N] **Thirty minutes mobile phone use has no short-term adverse effects on central auditory pathways.** VIEW
Arai N, Enomoto H, Okabe S, Yuasa K, Kamimura Y, Ugawa Y
Clin Neurophysiol. 114(8):1390-394, 2003

[N] **Ultrawideband radiation and pentylenetetrazol-induced convulsions in rats** VIEW
Miller SA, Bronson ME, Murphy MR
Bioelectromagnetics 20(5):327-329, 1999

[NA] **Effects of manual versus voice-activated dialing during simulated driving.** VIEW
Jenness JW, Lattanzio RJ, O'Toole M, Taylor N, Pax C
Percept Mot Skills 94(2):363-379, 2002

[NA] **Effects of prolonged wakefulness combined with alcohol and hands-free cell phone divided attention tasks on simulated driving.** VIEW
Iudice A, Bonanni E, Gelli A, Frittelli C, Iudice G, Cignoni F, Ghicopulos I, Murri L.
Hum Psychopharmacol. Jan 13 2005

[NA] **Energy Evaluation of MW effects on ACh receptor channels with parallel computing** VIEW
Apollonio F, D'Inzeo G, Tarricone L.
Electromag. Biol. Med. 19:69-79, 2000

[NA] **Factors influencing the use of cellular (mobile) phone during driving and hazards while using it.** VIEW
Poysti L, Rajalin S, Summala H.
Accid Anal Prev. 37(1):47-51, 2005

[NA] **Local vasodilator response to mobile phones.** VIEW
Paredi P, Kharitonov SA, Hanazawa T, Barnes PJ,
Laryngoscope 111(1):159-162, 2001

[NA] **Low-frequency pulsed electromagnetic fields influence EEG of man** VIEW
Von Klitzing L
Phys. Medica 11:77-80, 1995

[NA] **Management of radiofrequency radiation overexposures** VIEW
Hocking B,
Aust Fam Physician 30(4):339-342, 2001

[NA] **Microwave auditory effect- a comparison of some possible transduction mechanisms.** VIEW
Lin JC
J Microwave Power. 1976 Mar;11(1):77-81. 1976

[NA] **Microwave sickness: a reappraisal.** VIEW
Hocking B ,
Occup Med (Lond) 51(1):66-69, 2001

[NA] **Mobile phones, web chat, and sex among Norwegian adolescents** VIEW
Pedersen W
Tidsskr Nor Laegeforen. 124(13-14):1756-1759, 2004

[NA] **Skin temperature increase caused by a mobile phone: A methodological infrared camera study.** VIEW
Straume A, Oftedal G, Johnsson A.
Bioelectromagnetics. Jun 1; 2005

[Y] **A Preliminary Study to Assess Possible Chromosomal Damage Among Users of Digital Mobile Phones** VIEW
Gadhia PK, Shah T, Mistry A, Pithawala M, Tamakuwala D.
Electromag. Biol. Med. 22:149-159, 2003

[Y] **A Preliminary Study to Assess Possible Chromosomal Damage Among Users of Digital Mobile Phones.** VIEW
Gadhia PK, Shah T, Mistry A, Pithawala M, Tamakuwala D
Electromag Biol Med 22:149-159, 2003

[Y] **A survey study on some neurological symptoms and sensations experienced by long term users of mobile phones.** VIEW
Balikci K, Cem Ozcan I, Turgut-Balik D, Balik HH.
Pathol Biol (Paris). 53(1):30-34, 2005

[Y] **Acute mobile phone effects on pre-attentive operation.** VIEW
Papageorgiou CC, Nanou ED, Tsiafakis VG, Kapareliotis E, Kontoangelos KA, Capsalis CN, Rabavilas AD, Soldatos CR.
Neurosci Lett. Jan 4; 2006

[Y] **Acute mobile phone operation affects neural function in humans.** VIEW
Croft R, Chandler J, Burgess A, Barry R, Williams J, Clarke A.
Clin Neurophysiol 113(10):1623, 2002

[Y] **Are thyroid dysfunctions related to stress or microwave exposure (900 MHz)?** VIEW
Bergamaschi A, Magrini A, Ales G, Coppetta L, Somma G.
Int J Immunopathol Pharmacol. 17(2 Suppl):31-36, 2004

[Y] **Association of mobile phone radiation with fatigue, headache, dizziness, tension and sleep disturbance in Saudi population.** VIEW
Al-Khlaiwi T, Meo SA.
Saudi Med J. 25(6):732-736, 2004

[Y] **Cell phone use and visual attention.** VIEW
Golden C, Golden CJ, Schneider B
Percept Mot Skills. 97(2):385-389, 2003

[Y] **Cellular phone effects on otoacoustic emissions** VIEW
Grisanti G, Parlapiano C, Tamburello CC, Tine G, Zanforlin L
IEEE MTT-S Digest 2: 771-774, 1998

[Y] **Cellular phone electromagnetic field effects on bioelectric activity of human brain.** VIEW
Lebedeva NN, Sulimov AV, Sulimova OP, Kotrovskaya TI, Gailus T,
Crit Rev Biomed Eng 28(1-2):323-37, 2000

[Y] **Cellular telephone use and excreton of a urinary melatonin metabolite.** VIEW
Burch JB, Reif JS, Pitrat CA, Keele TJ, Yost MG,
Abstract of the Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery & Use of Electricity, San Diego, CA, 1997,

[Y] **Changes in human EEG caused by low level modulated microwave stimulation.** VIEW
Hinrikus H, Parts M, Lass J, Tuulik V.
Bioelectromagnetics. 25(6):431-440, 2004

[Y] **Combined effects of traffic and electromagnetic fields on the immune system of fertile atopic women.** VIEW
Del Signore A, Boscolo P, Kouri S, Di Martino G, Giuliano G,
Ind Health 38(3):294-300, 2000

[Y] **Disturbances of glucose tolerance in workers exposed to electromagnetic radiation** VIEW
Bielski J, Sikorski M,
Med Pr 47(3):227-231, 1996

[Y] **Driven to distraction: dual-Task studies of simulated driving and conversing on a cellular telephone** VIEW
Strayer DL, Johnston WA.
Psychol Sci 12(6):462-466, 2001

[Y] **Effect of 902 MHz mobile phone transmission on cognitive function in children.** VIEW
Preece AW, Goodfellow S, Wright MG, Butler SR, Dunn EJ, Johnson Y, Manktelow TC, Wesnes K.
Bioelectromagnetics. Jun 1; 2005

[Y] **Effect of a 915-MHz simulated mobile phone signal on cognitive function in man.** VIEW
Preece AW, Iwi G, Davies-Smith A, Wesnes K, Butler S, Lim E, Varey A
Int J Radiat Biol 75(4):447-456, 1999

[Y] **Effect of cellular telephone conversations and other potential interference on reaction time in a braking response.** VIEW
Consiglio W, Driscoll P, Witte M, Berg WP
Accid Anal Prev 35(4):495-500, 2003

[Y] **Effect on human attention of exposure to the electromagnetic field emitted by mobile phones** VIEW
Lee TMC, Ho SMY, Tsang LYH, Yang SYC, Li LSW, Chan CCH,
NeuroReport 12:729-731, 2001

[Y] **Effects of 7 Hz-modulated 450 MHz electromagnetic radiation on human performance in visual memory tasks.** VIEW
Lass L, Tuulik V, Ferenets CR, Riisalo R, Hinrikus H
Int. J. Rad. Biol. 78: 937-944, 2002

[Y] **Effects of 902 MHz electromagnetic field emitted by cellular telephones on response times in humans.** VIEW
Koivisto M, Revonsuo A, Krause C, Haarala C, Sillanmaki L, Laine M, Hamalainen H
Neuroreport 11(2):413-415, 2000

[Y] **Effects of acute exposure to the radiofrequency fields of cellular phones on plasma lipid peroxide and antioxidase activities in human erythrocytes** VIEW
Moustafa YM, Moustafa RM, Belacy A, Abou-El-Ela SH, Ali FM.
J Pharm Biomed Anal 26(4):605-608, 2001

[Y] **Effects of electromagnetic field emitted by cellular phones on the EEG during a memory task.** VIEW
Krause CM, Sillanmaki L, Koivisto M, Haggqvist A, Saarela C, Revonsuo A, Laine M,
Neuroreport Mar 20;11(4):761-4 2000

[Y] **Effects of electromagnetic field emitted by cellular phones on the EEG during a memory task.** VIEW
Krause CM, Sillanmaki L, Koivisto M, Haggqvist A, Saarela C, Revonsuo A, Laine M, Hamalainen H
Neuroreport 11(4):761-764, 2000

[Y] **Effects of electromagnetic field emitted by cellular phones on the EEG during a memory task.** VIEW
Krause CM, Sillanmaki L, Koivisto M, Haggqvist A, Saarela C, Revonsuo A, Laine M, Hamalainen H
Medline record in process, 1999

[Y] **Effects of electromagnetic fields emitted by cellular phones on the electroencephalogram during a visual working memory task.** VIEW
Krause CM, Sillanmaki L, Koivisto M, Haggqvist A, Saarela C, Revonsuo A, Laine M, Hamalainen H,
Int J Radiat Biol 76(12):1659-1667, 2000

[Y] **Effects of electromagnetic fields produced by radiotelevision broadcasting stations on the immune system of women** VIEW
Boscol P, Di Sciascio MB, D'Ostilio S, Del Signore A, Reale M, Conti P, Bavazzano P, Paganelli R, Di Gioacchino M.
Sci Total Environ 273(1-3):1-10, 2001

[Y] **Effects of fexofenadine and hydroxyzine on brake reaction time during car-driving with cellular phone use.** VIEW
Tashiro M, Horikawa E, Mochizuki H, Sakurada Y, Kato M, Inokuchi T, Ridout F, Hindmarch I, Yanai K.
Hum Psychopharmacol. Aug 5; 2005

[Y] **Effects of GSM electromagnetic field on the MEG during an encoding-retrieval task.** VIEW
Hinrichs H, Heinze HJ
Neuroreport. 15(7):1191-1194, 2004

[Y] **Effects of GSM signals on auditory evoked responses** VIEW
Maby E, Jeannes RL, Faucon G, Liegeois-Chauvel C, De Seze R.
Bioelectromagnetics. May 10; 2005

[Y] **Effects of microwaves emitted by cellular phones on human slow brain potentials.** VIEW
Freude G, Ullsperger P, Eggert S, Ruppe I,
Bioelectromagnetics 19(6):384-387, 1998

[Y] **Effects of mobile GSM radiotelephone exposure on the auditory brainstem response (ABR)** VIEW
Kellenyi L, Thuroczy G, Faludy B, Lenard L
eurobiology 7:79-81, 1999

[Y] **Effects of pulsed electromagnetic fields on cognitive processes - a pilot study on pulsed field interference with cognitive regeneration.** VIEW
Maier R, Greter SE, Maier N
Acta Neurol Scand. 110(1):46-52, 2004

[Y] **Effects of pulsed high-frequency electromagnetic fields on human sleep** VIEW
Mann K, Roschke J
Neuropsychobiology 33(1):41-47, 1996

[Y] **Effects of radiofrequency radiation emitted by cellular telephones on the cognitive functions of humans.** VIEW
Eliyahu I, Luria R, Hareuveny R, Margaliot M, Meiran N, Shani G
Bioelectromagnetics. Nov 22; 2005

[Y] **Effects of the 1900 MHz Electromagnetic Field Emitted from Cellular Phone on Nocturnal Melatonin Secretion.** VIEW
0Jarupat S, Kawabata A, Tokura H, Borkiewicz A
J Physiol Anthropol Appl Human Sci 22(1):61-63, 2003

[Y] **Electromagnetic field of mobile phones affects visual event related potential in patients with narcolepsy** VIEW
Jech R, Sonka K, Růzicka E, Nebuzelsky A, Bohm J, Juklickov M, Nevsimalova S.
Bioelectromagnetics 22(7):519-528, 2001

[Y] **Electromagnetic fields, such as those from mobile phones, alter regional cerebral blood flow and sleep and waking EEG.** VIEW
Huber R, Treyer V, Borbély AA, Schuderer J, Gottselig JM, Landolt H-P, Werth E, Berthold T, Kuster N, Buck A, Achermann P
J Sleep Res 11: 289-295, 2002

[Y] **Enhancement of allergic skin wheal responses by microwave radiation from mobile phones in patients with atopic eczema/dermatitis syndrome.** VIEW
Kimata H
Int Arch Allergy Immunol 129(4):348-350, 2002

[Y] **Evaluation of selected functional circulation parameters of workers from various occupational groups exposed to electromagnetic fields of high frequency. III.** VIEW
Gadzicka E, Bortkiewicz A, Zmyslony M, Palczynski C
Med Pr 48(1):15-24, 1997

[Y] **Evaluation of selected parameters of circulatory system function in various occupational groups exposed to high frequency electromagnetic fields. II. Electrocardiographic changes** VIEW
Bortkiewicz A, Zmyslony M, Gadzicka E, Szymczak W
Med Pr 47(3):241-252, 1996

[Y] **Exposure to extremely-low-frequency electromagnetic fields and radiofrequency radiation: cardiovascular effects in humans.** VIEW
Jauchem JR
Int Arch Occup Environ Health 70(1):9-21, 1997

[Y] **Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG** VIEW
Huber R, Graf T, Cote KA, Wittmann L, Gallmann E, Matter D, Schuderer J, Kuster N, Borbely AA, Achermann P,
Neuroreport 11(15):3321-3325, 2000

[Y] **Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG** VIEW
Huber R, Graf T, Cote KA, Wittmann L, Gallmann E, Matter D, Schuderer J, Kuster N, Borbely AA, Achermann P
NeuroReport Volume 11, number 15, 3321-3325, 2000

[Y] **Exposure to pulse-modulated radio frequency electromagnetic fields affects regional cerebral blood flow** VIEW
Huber R, Treyer V, Schuderer J, Berthold T, Buck A, Kuster N, Landolt HP, Achermann P
Eur J Neurosci. 21(4):1000-1006, 2005

[Y] **Gender related differences on the EEG during a simulated mobile phone signal.** VIEW
Papageorgiou CC, Nanou ED, Tsiafakis VG, Capsalis CN, Rabavilas AD
Neuroreport. 15(16):2557-2560, 2004

[Y] **GSM radiocellular telephones do not disturb the secretion of antepituitary hormones in humans.** VIEW
de Seze R, Fabbro-Peray P, Miro L,
Bioelectromagnetics 19(5):271-278, 1998

[Y] **Hematological changes in peripheral blood of workers occupationally exposed to microwave radiation.** VIEW
Goldoni J,
Health Physics 58:205-207, 1990

[Y] **Human brain wave activity during exposure to radiofrequency field emissions from mobile phones.** VIEW
D'Costa H, Trueman G, Tang L, Abdel-rahman U, Abdel-rahman W, Ong K,

Cosic I
Australas Phys Eng Sci Med. 26(4):162-167, 2003

[Y] **Investigation of brain potentials in sleeping humans exposed to the electromagnetic field of mobile phones.** VIEW
Lebedeva NN, Sulimov AV, Sulimova OP, Korotkovskaya TI, Gailus T,
Crit Rev Biomed Eng 29(1):125-133, 2001

[Y] **Is the brain influenced by a phone call? An EEG study of resting wakefulness.** VIEW
Curcio G, Ferrara M, Moroni F, D'Inzeo G, Bertini M, De Gennaro L.
Neurosci Res. Aug 12; 2005

[Y] **Is there a relationship between cell phone use and semen quality?** VIEW
Fejes I, Za Vaczki Z, Szollosi J, Kolosza R S, Daru J, Kova Cs L, Pa LA
rch Androl. 51(5):385-393, 2005

[Y] **Laughter counteracts enhancement of plasma neurotrophin levels and allergic skin wheal responses by mobile phone-mediated stress.** VIEW
Kimata H.
Behav Med. 29(4):149-152, 2004

[Y] **Melatonin metabolite excretion among cellular telephone users.** VIEW
Burch JB, Reif JS, Noonan CW, Ichinose T, Bachand AM, Koleber TL, Yost MG
Int J Rad Biol 78: 1029-1036, 2002

[Y] **Micronucleus assay and lymphocyte mitotic activity in risk assessment of occupational exposure to microwave radiation** VIEW
Garaj-Vrhovac V,
Chemosphere;39(13):2301-2312, 1999

[Y] **Microwaves emitted by cellular telephones affect human slow brain potentials.** VIEW
Freude G, Ullsperger P, Eggert S, Ruppe I,
Eur J Appl Physiol 81(1-2):18-27, 2000

[Y] **Mobile phone use facilitates memory in male, but not female, subjects.** VIEW
Smythe JW, Costall B
Neuroreport 14(2):243-246, 2003

[Y] **Mobile phones modulate response patterns of human brain activity.** VIEW
Eulitz C, Ullsperger P, Freude G, Elbert T,
Neuroreport 9(14):3229-3232, 1998

[Y] **Non-ionizing electromagnetic radiations, emitted by a cellular phone, modify cutaneous blood flow.** VIEW
Monfrecola G, Moffa G, Procaccini EM
Dermatology. 207(1):10-14, 2003

[Y] **Nonthermal GSM microwaves affect chromatin conformation in human lymphocytes similar to heat shock** VIEW
Sarimov R, Malmgren L.O.G., Markova, E., Persson, B.R.R.. Belyaev, I.Y.
IEEE Trans Plasma Sci 32:1600-1608, 2004

[Y] **Perceptual and attentional effects on drivers' speed selection at curves.** VIEW
Charlton SG
Accid Anal Prev. 36(5):877-884, 2004

[Y] **Perceptual and attentional effects on drivers' speed selection at curves.** VIEW
Charlton SG
Accid Anal Prev. 36(5):877-884, 2004

[Y] **Preliminary report: symptoms associated with mobile phone use.** VIEW
Hocking B
Occup Med (Lond);48(6):357-360, 1998

[Y] **Psychophysiological tests and provocation of subjects with mobile phone related symptoms** VIEW
Wilen J, Johansson A, Kalezic N, Lyskov E, Sandstrom M
Bioelectromagnetics. Nov 22; 2005

[Y] **Pulsed high-frequency electromagnetic field affects human sleep and sleep electroencephalogram.** VIEW
Borbely AA, Huber R, Graf T, Fuchs B, Gallmann E, Achermann P
Neurosci Lett 275(3):207-210, 1999

[Y] **Radio frequency electromagnetic field exposure in humans: Estimation of SAR distribution in the brain, effects on sleep and heart rate.** VIEW
Huber R, Schuderer J, Graf T, Jutz K, Borbely AA, Kuster N, Achermann P
Bioelectromagnetics 24(4):262-276, 2003

[Y] **Reproductive function in relation to duty assignments among military personnel.** VIEW
Schrader SM, Langford RE, Turner TW, Breitenstein MJ, Clark JC, Jenkins BL, Lundy DO, Simon SD, Weyandt TB
Reprod Toxicol 12(4):465-468, 1998

[Y] **Resting blood pressure increase during exposure to a radio-frequency electromagnetic field.** VIEW
Braune S, Wrocklage C, Raczek J, Gailus T, Lucking CH,
Lancet 351(9119):1857-1858, 1998

[Y] **Subjective symptoms related to mobile phone use** VIEW
Szyjkowska A, Bortkiewicz A, Szymczak W, Makowiec-Dabrowska T.
Pol Merkuriusz Lek. 19(112):529-532, 2005

[Y] **Symptoms experienced by users of digital cellular phones:** VIEW
Santini R, Seigne M, Bonhomme-Faivre L, Bouffet S, Defrasne E, Sage M.
Pathol Biol (Paris) 49(3):222-226, 2001

[Y] **The acute effects of exposure to the electromagnetic field emitted by mobile phones on human attention** VIEW
Edelstyn N, Oldershaw A
Neuroreport 13(1):119-121, 2002

[Y] **The analysis of animal bioelectric brain activity influenced by microwaves or by the introduction of strychnine.** VIEW
Sidorenko AV,
Bioelectrochem Bioenerg 48(1):223-226, 1999

[Y] **The effect of electromagnetic fields emitted by mobile phones on human sleep.** VIEW
Loughran SP, Wood AW, Barton JM, Croft RJ, Thompson B, Stough C.
Neuroreport. 16(17):1973-1976, 2005

[Y] **The effect of low level radiofrequency electromagnetic radiation on the excretion rates of stress hormones in operators during 24-hour shifts.** VIEW
Vangelova K, Israel M, Mihaylov S
Cent Eur J Public Health 10(1-2):24-28, 2002

[Y] **The effects of electromagnetic field emitted by GSM phones on working memory.** VIEW
Koivisto M, Krause CM, Revonsuo A, Laine M, Hamalainen H
Neuroreport 2000 Jun 5;11(8):1641-3, 2000

[Y] **The influence of electromagnetic fields on human brain activity.** VIEW
Reiser H, Dimpfel W, Schober F
Eur J Med Res 1(1):27-32, 1995

[Y] **Time-course of electromagnetic field effects on human performance and tympanic temperature.** VIEW
Curcio G, Ferrara M, De Gennaro L, Cristiani R, D'Inzeo G, Bertini M.
Neuroreport. 15(1):161-164, 2004

[Y] **Turning gap acceptance decision-making: the impact of driver distraction.** VIEW
Cooper PJ, Zheng Y
J Safety Res 33(3):321-335, 2002

[Y] **Variations of melatonin and stress hormones under extended shifts and radiofrequency electromagnetic radiation.** VIEW
Vangelova KK, Israel MS
Rev Environ Health. 20(2):151-161, 2005

[Y] **Visual field attention is reduced by concomitant hands-free conversation on a cellular telephone.** VIEW
Barkana Y, Zadok D, Morad Y, Avni I.
Ophthalmol. 138(3):347-353, 2004

DOSIMETRY (58)

[N] **A discussion of potential exposure metrics for use in epidemiological studies on human exposure to radiowaves from mobile phone base stations.** VIEW
Schuz J, Mann S,
J Expo Anal Environ Epidemiol 10(6 Pt 1):600-605, 2000

[N] **Comparison of numerical and experimental methods for determination of SAR and radiation patterns of handheld wireless telephones.** VIEW
Gandhi OP, Lazzi G, Tinniswood A, Yu QS,
Bioelectromagnetics Suppl 4:93-101, 1999

[N] **Comparison of power deposition patterns produced by microwave and radio frequency cardiac ablation catheters.** VIEW
Lin JC, Wang YL, Hariman RJ,
Electronics Letters. 30(12):922-923, 1994

[N] **Electromagnetic field pattern in the environment of GSM base stations.** VIEW
Aniolczyk H
Int J Occup Med Environ Health 12(1):47-58 1999

[N] **Experimental study on thermal damage to dog normal brain. Int J Hyperthermia** VIEW
Ikeda N, Hayashida O, Kameda H, Ito H, Matsuda T,
Int J Hyperthermia 10(4):553-561, 1994

[N] **Exposure limits for ultra-short wave radiation in work environments.** VIEW
Zhao Z, Zhang S, Wang S, Yao Z, Zho H, Tao S, Tao L,
Rev Environ Health 10(3-4):217-220, 1994

[N] **Foot currents and ankle SARs induced by dielectric heaters.** VIEW
Conover DL, Moss CE, Murray WE, Edwards RM, Cox C, Grajewski B, Werren DM, Smith JM,
Bioelectromagnetics 13(2):103-110, 1992

[N] **Human exposure at two radio frequencies (450 and 2450 MHz): similarities and differences in physiological response.** VIEW
Adair ER, Cobb BL, Mylacraine KS, Kelleher SA,
Bioelectromagnetics Suppl 4:12-20, 1999

[N] **Specific absorption rate levels measured in a phantom head exposed to radio frequency transmissions from analog hand-held mobile phones.** VIEW
Anderson V, Joyner KH,
Bioelectromagnetics 16(1):60-69, 1995

[N] **Two-step exposure of biological objects to infrared laser and microwave radiation** VIEW
Kol'tsov IuV, Korolev VN, Kusakin SA,
Biofizika 44(2):378-381, 1999

[NA] **A numerical and experimental comparison of human head phantoms for compliance testing of mobile telephone equipment.** VIEW
Christ A, Chavannes N, Nikoloski N, Gerber HU, Pokovic K, Kuster N.
Bioelectromagnetics. 26(2):125-137, 2005

[NA] **A thermal model for human thresholds of microwave-evoked warmth sensations.** VIEW
Riu PJ, Foster KR, Blick DW, Adair ER,
Bioelectromagnetics 18(8):578-583, 1997

[NA] **Absence of radiofrequency heating from auditory implants during magnetic resonance imaging.** VIEW
Chou CK, McDougall JA, Can KW,
Bioelectromagnetics 16(5):307-316, 1995

[NA] **Age does not affect thermal and cardiorespiratory responses to microwave heating in calorically restricted rats** VIEW
Ryan KL, Walters TJ, Tehrany MR, Lovelace JD, Jauchem JR
Shock 8(1):55-60, 1997

[NA] **Amino acid concentrations in hypothalamic and caudate nuclei during microwave-induced thermal stress: analysis by microdialysis.** VIEW
Mason PA, Escarciga R, Doyle JM, Romano WF, Berger RE, Donnellan JP
Bioelectromagnetics 18(3):277-283, 1997

[NA] **Analysis of the influence of the cell geometry, orientation and cell proximity effects on the electric field distribution from direct RF exposure.** VIEW
Sebastian JL, Munoz S, Sancho M, Miranda JM,
Phys Med Biol 46(1):213-225, 2001

[NA] **Antenna modeling considerations for accurate SAR calculations in human phantoms in close proximity to GSM cellular base station antennas.** VIEW
van Wyk MJ, Bingle M, Meyer FJ
Bioelectromagnetics. Jun 1 2005

[NA] **Assessment of radiofrequency exposure from cellular telephone daily use** VIEW
Berg G, Schuz J, Samkange-Zeeb F, Blettner M
J Expo Anal Environ Epidemiol. Jul 21 2004

[NA] **Assessment of the magnetic field exposure due to the battery current of digital mobile phones** VIEW
Jokela K, Puranen L, Sihvonen AP.
Health Phys. 86(1):56-66, 2004

[NA] **Assessment of the temporal trend of the exposure of people to electromagnetic fields produced by base stations for mobile telephones** VIEW
Silvi A M, Zari A, Licitra G.
Radiat Prot Dosimetry 97(4):387-390, 2001

[NA] **Calculation of change in brain temperatures due to exposure to a mobile phone** VIEW
Van Leeuwen GM, Lagendijk JJ, Van Leersum BJ, Zwamborn AP, Hornsleth SN, Kotte AN
Phys Med Biol 44(10):2367-2379, 1999

[NA] **Characteristics of microwave evoked body movements in mice.** VIEW
Brown DO, Lu ST, Elson EC
Bioelectromagnetics 15(2):143-161, 1994

[NA] **Comparison of FDTD-calculated specific absorption rate in adults and children when using a mobile phone at 900 and 1800 MHz.** VIEW
Martinez-Burdalo M, Martin A, Anguiano M, Villar R.
Phys Med Biol. 49(2):345-354, 2004

[NA] **Comparison of radio frequency energy absorption in ear and eye region of children and adults at 900, 1800 and 2450 MHz.** VIEW
Keshvari J, Lang S.
Phys Med Biol. 50(18):4355-4369, 2005

[NA] **Comparisons of peak SAR levels in concentric sphere head models of children and adults for irradiation by a dipole at 900 MHz.** VIEW
Anderson V
Phys Med Biol. 48(20):3263-3275, 2003

[NA] **Computation of high-resolution SAR distributions in a head due to a radiating dipole antenna representing a hand-held mobile phone.** VIEW
Van de Kamer JB, Lagendijk, JJW
Phys. Med. Biol. 47:1827-1835, 2002

[NA] **Determinants of exposure to electromagnetic fields from mobile phones.** VIEW
Ardoino L, Barbieri E, Vecchia P.
Radiat Prot Dosimetry. 111(4):403-406, 2004

[NA] **Electromagnetic interference of external pacemakers by walkie-talkies and digital cellular phones: experimental study.** VIEW
Trigano AJ, Azoulay A, Rochdi M, Campillo A
Pacing Clin Electrophysiol 22(4 Pt 1):588-593, 1999

[NA] **EMF: Human Safety Issues.** VIEW
Gandhi OP
Annu Rev Biomed Eng 4:211-234, 2002

[NA] **Evaluation of the levels of radiofrequency electromagnetic fields** VIEW
L'Abbate N, Pranzo S, Martucci V, Rella C, Vitucci L, Salamanna S.
G Ital Med Lav Ergon. 26(1):19-27, 2004

[NA] **Eye heating caused by microwave ovens** VIEW
Leitgeb N, Tropper K,
Biomed Tech (Berl) 38(1-2):17-20, 1993

[NA] **Heating and pain sensation produced in human skin by millimeter waves: comparison to a simple thermal model** VIEW
Walters TJ, Blick DW, Johnson LR, Adair ER, Foster KR
Health Phys 78(3):259-267, 2000

[NA] **Microwave emissions from police radar** VIEW
Fink JM, Wagner JP, Congleton JJ, Rock JC,
Am Ind Hyg Assoc J 60(6):770-76, 1999

[NA] **Microwave-induced hearing: some preliminary theoretical observations** VIEW
Lin JC
J Microwave Power. 1976 Sep;11(3):295-8 1976

[NA] **Negligible electromagnetic interaction between medical electronic equipment and 2.4 GHz band wireless LAN.** VIEW
Hanada E, Hoshino Y, Oyama H, Watanabe Y, Nose Y
J Med Syst 26(4):301-308, 2002

[NA] **Neurological effects of radiofrequency radiation.** VIEW
Hocking B, Westerman R.
Occup Med (Lond) 53(2):123-127, 2003

[NA] **Nonthermal effects of mobile-phone frequency microwaves on uteroplacental functions in pregnant rats.** VIEW
Nakamura H, Matsuzaki I, Hatta K, Nobukuni Y, Kambayashi Y, Ogino K
Reprod Toxicol 2003 17(3):321-326, 2003

[NA] **Numerical assessment of induced ELF Currents in the human head due to the battery current of a digital mobile phone** VIEW
Ilvonen S, Sihvonen AP, Karkkainen K, Sarvas J.
Bioelectromagnetics. Sep 27; 2005

[NA] **On the evaluation of the influence of cellular phones on their users.** VIEW
Khudnitskii SS, Moshkarev EA, Fomenko TV
Med Tr Prom Ekol (9):20-24, 1999

[NA] **On the safety assessment of human exposure in the proximity of cellular communications base-station antennas at 900, 1800 and 2170 MHz** VIEW
Martinez-Burdalo M, Martin A, Anguiano M, Villar R
Phys Med Biol. 50(17):4125-4137, 2005

[NA] **Output power levels from mobile phones in different geographical areas; implications for exposure assessment** VIEW
Lonn S, Forssen U, Vecchia P, Ahlbom A, Feychting M
Occup Environ Med. 61(9):769-772, 2004

[NA] **Physiological interaction processes and radio-frequency energy absorption.** VIEW
Adair ER, Adams BW, Hartman SK,
Bioelectromagnetics 13(6):497-512, 1992

[NA] **Population exposure to electromagnetic fields generated by radio base stations: evaluation of the urban background by using provisional model and instrumental measurements** VIEW
Anglesio L, Benedetto A, Bonino A, Colla D, Martire F, Saudino Fusette S, d'Amore G.
Radiat Prot Dosimetry 97(4):355-358, 2001

[NA] **Recall of past use of mobile phone handsets.** VIEW
Parslow RC, Hepworth SJ, McKinney PA
Radiat Prot Dosimetry. 106(3):233-240, 2003

[NA] **Regional brain heating during microwave exposure (2.06 GHz), warm-water immersion, environmental heating and exercise.** VIEW
Walters TJ, Ryan KL, Belcher JC, Doyle JM, Tehrany MR, Mason PA
Bioelectromagnetics 19(6):341-53, 1998

[NA] **RF Exposure During Use of Electrosurgical Units** VIEW
Liljestrand B, Sandström M, Hansson Mild K.
Electromag. Biol. Med. 22:129-132, 2003

[NA] **Simulation of Exposure and SAR Estimation for Adult and Child Heads Exposed to Radiofrequency Energy from Portable Communication Devices** VIEW
Bit-Babik, G., Guy, A. W., Chou, C-K., Faraone, A., Kanda, M., Gessner, A., Wang, J. and Fujiwara, O.
Radiat. Res. 163, 580-590 , 2005

[NA] **Study of subgridding in SAR computation for the cochlea.** VIEW
Kopecky R, Hamnerius Y, Persson M.
Bioelectromagnetics. 26(6):520-522, 2005

[NA] **Survey of RF exposure levels from mobile telephone base stations in Australia** VIEW
Henderson SI, Bangay MJ.
Bioelectromagnetics. 27(1):73-76, 2006

[NA] **Thermal effects of radiation from cellular telephones.** VIEW
Wainwright P,
Phys Med Biol 45(8):2363-2372, 2000

[NA] **Thermal effects of radiation from cellular telephones.** VIEW
Wainwright P
Phys Med Biol 45(8):2363-2372, 2000

[NA] **Thermophysiological responses of human volunteers during controlled whole-body radio frequency exposure at 450 MHz.** VIEW
Adair ER, Kelleher SA, Mack GW, Morocco TS,
Bioelectromagnetics 19(4):232-245, 1998

[NA] **Thermophysiological responses of human volunteers to whole body RF exposure at 220 MHz.** VIEW
Adair ER, Blick DW, Allen SJ, Mylacraine KS, Ziriax JM, Scholl DM.
Bioelectromagnetics. May 19 2005

[NA] **Zeeman-Stark modeling of the RF EMF interaction with ligand binding.** VIEW
Chiabrera A, Bianco B, Moggia E, Kaufman JJ,
Bioelectromagnetics 21(4):312-324, 2000

[Y] **Differences in energy absorption between heads of adults and children in the near field of sources** VIEW
Schonborn F, Burkhardt M, Kuster N,
Health Phys 74(2):160-168, 1998

[Y] **Electromagnetic interference of GSM mobile phones with the implantable deep brain stimulator, ITREL-III** VIEW
Kainz W, Alesch F, Chan DD
Biomed Eng Online 2(1):11, 2003

[Y] **Resonance interactions of surface charged lipid vesicles with the microwave electromagnetic field** VIEW
Krasil'nikov PM,
Biofizika 44(6):1078-1082, 1999

[Y] **Thresholds of microwave-evoked warmth sensations in human skin.** VIEW
Blick DW, Adair ER, Hurt WD, Sherry CJ, Walters TJ, Merritt JH
Bioelectromagnetics 18(6):403-409, 1997

MISCELLANEOUS (102)

[N] **A practical procedure to prevent electromagnetic interference with electronic medical equipment** VIEW
Hanada E, Takano K, Antoku Y, Matsumura K, Watanabe Y, Nose Y
J Med Syst 26(1):61-65, 2002

[N] **Biological aspects of mobile communication fields** VIEW
Lin JC,
Wireless Networks 3 (6) , pp. 439-453, 1997

[N] **Biological effects of non-ionizing electromagnetic energy:** VIEW
Havas M
Environ Rev. 8: 173-253 Dossiers Environ. 2001 **NOTE: 50/60 Hz study**

[N] **Catheter microwave ablation therapy for cardiac arrhythmias.** VIEW
Lin JC
Bioelectromagnetics Suppl 4:120-132, 1999

[N] **Characterization of electromagnetic interference of medical devices in the hospital due to cell phones** VIEW
Morrissey JJ, Swicord M, Balzano Q
Health Phys 82(1):45-51, 2002

[N] **Comparison of dose dependences for bioeffects of continuous-wave and high-peak power microwave emissions using gel-suspended cell cultures.** VIEW
Pakhomov AG, Gaj ek P, Allen L, Stuck BE, Murphy MR.
Bioelectromagnetics 23: 158-167, 2002

[N] **Differences in RF energy absorption in the heads of adults and children** VIEW
Christ A, Kuster N.
Bioelectromagnetics. Sep 2; 2005

[N] **Electromagnetic compatibility (EMC) of cellular phones and pacemakers** VIEW
Geller L, Thuroczy G, Merkely B
Orv Hetil 142(36):1963-1970, 2001

[N] **Health aspects of radio and microwave radiation.** VIEW
Lin JC
J Environ Pathol Toxicol. Jul-Aug;2(6):1413-32. 1979

[N] **Interactive Multimedia Communication System Radiation & its Health Impact** VIEW
Lin JC
Global Communications Interactive , R. Struzak, ed., Hanson Cooke, London, September, 1997,

[N] **Neurological changes induced by a mobile phone.** VIEW
Hocking B, Westerman R
Occup Med (Lond) 52(7):413-415, 2002

[N] **No mutagenic or recombinogenic effects of mobile phone fields at 900 MHz detected in the yeast saccharomyces cerevisiae.** VIEW
Gos P, Eicher B, Kohli J, Heyer WD,
Bioelectromagnetics 21(7):515-523, 2000

[N] **Non-ionizing radiation exposure causing ill-health and alopecia areata.** VIEW
Isa AR, Noor M,
Med J Malaysia 46(3):235-238, 1991

[N] **Safe use of mobile phones in hospitals** VIEW
Hietanen M, Sibakov V, Hallfors S, von Nandelstadh P,
Health Phys 79(5 Suppl):S77-84, 2000

[N] **The Australian experience: global system for mobile communications wireless telephones and hearing aids.** VIEW
Byrne D, Burwood E
J Am Acad Audiol 12(6):315-321, 2001

[NA] **A cerebral primitive neuroectodermal tumor in a squirrel monkey (Saimiri sciureus)** VIEW
Johnson EH, Chima SC, Muirhead DE,
J Med Primatol 28(2):91-96, 1999

[NA] **A follow-up study of electromagnetic interference of cellular phones on electronic medical equipment in the emergency department.** VIEW
Tat FH, Wah KC, Hung YH
Emerg Med (Fremantle) 14(3):315-319, 2002

[NA] **Alhekail ZO. Electromagnetic radiation from microwave ovens.** VIEW
Alhekail ZO.
J Radiol Prot 21(3):251-258, 2001

[NA] **Animal carcinogenicity studies on radiofrequency fields related to mobile phones and base stations.** VIEW

Dasenbrock C.
Toxicol Appl Pharmacol. Jul 20 2005

[NA] **Applicability of discovery science approach to determine biological effects of mobile phone radiation** VIEW
Leszczynski D, Nylund R, Joenvaara S, Reivinen J
Proteomics. 4(2):426-431, 2004

[NA] **Association between cellular-telephone calls and motor vehicle collisions.** VIEW
Redelmeier DA, Tibshirani RJ,
N Engl J Med 13;336(7):453-458, 1997

[NA] **Basic problems of diversely reported biological effects of radio frequency fields** VIEW
Chou CK
Radiats Biol Radioecol. 43(5):512-518, 2003

[NA] **Biological Effects of Electromagnetic Fields-Mechanisms for the Effects of Pulsed Microwave Radiation on Protein Conformation** VIEW
Laurence JA, French PW, Lindner RA, Mckenzie DR,
J Theor Biol 206(2):291-298, 2000

[NA] **Blast injury caused by a booby-trapped cellular phone.** VIEW
Lapid O, Lapid-Gortzak R, Glesinger R, Monos T, Shaked G
Injury. 35(3):336-338, 2004

[NA] **Car phones and car crashes: an ecologic analysis.** VIEW
Min ST, Redelmeier DA
Can J Public Health 89(3):157-161, 1998

[NA] **Cause-specific mortality in cellular telephone users.** VIEW
Dreyer NA, Loughlin JE, Rothman KJ,
JAMA 282(19):1814-1816, 1999

[NA] **Cellular phone dermatitis with chromate allergy** VIEW
Seishima M, Oyama Z, Oda M
Dermatology. 207(1):48-50, 2003

[NA] **Cellular phone interference testing of implantable cardiac defibrillators in vitro.** VIEW
Bassen HI, Moore HJ, Ruggera PS,
Pacing Clin Electrophysiol 21(9): 1709-1715, 1998

[NA] **Cellular phone interference with external cardiopulmonary monitoring devices.** VIEW
Tri JL, Hayes DL, Smith TT, Severson RP,
Mayo Clin Proc 76(1):11-15, 2001

[NA] **Cellular phones and fatal traffic collisions.** VIEW
Violanti JM
Accid Anal Prev 30(4):519-524, 1998

[NA] **Cellular phones and public health** VIEW
Leventhal A, Karsenty E, Sadetzki S.
Harefuah. 143(8):614-618, 620, 2004

[NA] **Cellular phones and traffic accidents.** VIEW
Violanti JM
Public Health 111(6):423-4 28, 1997

[NA] **Cellular phones and traffic accidents: an epidemiological approach.** VIEW
Violanti JM, Marshall JR
Accid Anal Prev 28(2):265-270, 1996

[NA] **Cochlear implants and GSM phone.** VIEW
Sorri MJ, Huttunen KH, Valimaa TT, Karinen PJ, Lopponen HJ,
Scand Audiol Suppl (52):54-56, 2001

[NA] **Cognitive load and detection thresholds in car following situations: safety implications for using mobile (cellular) telephones while driving.** VIEW
Lamble D, Kauranen T, Laakso M, Summala H
Accid Anal Pre ;31(6):617-623, 1999

[NA] **Concerns about sources of electromagnetic interference in patients with pacemakers** VIEW
Sakakibara Y, Mitsui T
Jpn Heart J 40(6):737-743, 1999

[NA] **Contribution of clinical teratologists and geneticists to the evaluation of the etiology of congenital malformations** VIEW
Graham JM Jr, Jones KL, Brent RL,
Teratology 59(4):307-313, 1999

[NA] **Could C- and D-network mobile phones endanger patients with pacemakers?** VIEW
Hofgartner F, Muller T, Sigel H
Dtsch Med Wochenschr 121(20):646-652, 1996

[NA] **Digital cellular telephone interaction with implantable cardioverter-defibrillators** VIEW
Fetter JG, Ivans V, Benditt DG, Collins J
J Am Coll Cardiol 31(3):623-628, 1998

[NA] **Effect of mobile phone on life-saving and life-sustaining systems.** VIEW
Irnich W, Tobisch R
Biomed Tech (Berl) 43(6):164-173, 1998

[NA] **Effects of acute exposure to ultrahigh radiofrequency radiation on three antenna engineers.** VIEW
Schilling CJ
Occup Environ Med 54(4):281-284, 1997

[NA] **Effects of an increased air gap on the in vitro interaction of wireless phones with cardiac pacemakers.** VIEW
Grant FH, Schlegel RE,
Bioelectromagnetics 21(7):485-490, 2000

[NA] **Effects of exposure to very high frequency radiofrequency radiation on six antenna engineers in two separate incidents.** VIEW
Schilling CJ
Occup Med 60:49-56, 2000

[NA] **Electromagnetic compatibility of electronic implants--review of the literature.** VIEW
Kainz W, Neubauer G, Alesch F, Schmid G, Jahn O.
Wien Klin Wochenschr 113(23-24):903-914, 2001

[NA] **Electromagnetic compatibility study of the in-vitro interaction of wireless phones with cardiac pacemakers.** VIEW
Schlegel RE, Grant FH, Raman S, Reynolds D
Biomed Instrum Technol 32(6):645-55, 1998

[NA] **Electromagnetic hypersensitivity (EHS) and subjective health complaints** VIEW
Seitz H, Stinner D, Eikmann T, Herr C, Roosli M.
Sci Total Environ. Jun 20 2005

[NA] **Electromagnetic interference between automatic defibrillators and digital and analog cellular telephones** VIEW
Jimenez A, Hernandez Madrid A, Pascual J, Gonzalez Rebollo JM, Fernandez E, Sanchez A, Ortega J, Lozano F, Munoz R, Moro C
Rev Esp Cardiol 51(5):375-382, 1998

[NA] **Electromagnetic interference of analog cellular telephones with pacemakers** VIEW
Barbaro V, Bartolini P, Donato A, Militello C,
Pacing Clin Electrophysiol 19(10):1410-1418, 1996

[NA] **Electromagnetic interference of bone-anchored hearing aids by cellular phones.** VIEW
Kompis M, Negri S, Hausler R
Acta Otolaryngol 120(7):855-859, 2001

[NA] **Electromagnetic interference of external pacemakers by walkie-talkies and digital cellular phones: experimental study.** VIEW
Trigano AJ, Azoulay A, Rochdi M, Campillo A
Pacing Clin Electrophysiol 22(4 Pt 1):588-593, 1999

[NA] **Electromagnetic interference of pacemakers by mobile phones.** VIEW
Irnich W, Batz L, Muller R, Tobisch R
Pacing Clin Electrophysiol 19(10):1431-1446, 1996

[NA] **Electromagnetic poles and reproduction.** VIEW
Indulski JA, Makowiec-Dabrowska T, Zmyslony M, Siedlecka J,
Med Pr 48(5):585-603, 1997

[NA] **From phenoxyacetic acids to cellular telephones: is there historical evidence for the precautionary principle in cancer prevention?** VIEW
Hardell L
Int J Health Serv. 34(1):25-37, 2004

[NA] **Genotoxic and gene expression effects of 836.62 MHz FMCW and 847.74 MHz CDMA exposure.** VIEW
Roti-Roti J, Hunt CR, Goswami PC, Moros EG, Pickard WF
Presented at BEMS in St Petersburg, Florida 1998

[NA] **How do mobile phones affect electromedical devices?** VIEW
Glenister H,
Nurs Times 94(15):44-45, 1998

[NA] **Implantable cardioverter defibrillators and cellular telephones: is there any interference?** VIEW
Occhetta E, Plebani L, Bortnik M, Sacchetti G, Trevi G
Pacing Clin Electrophysiol 22(7):983-989, 1999

[NA] **Influence of digital and analogue cellular telephones on implanted pacemakers.** VIEW

Altamura G, Toscano S, Gentilucci G, Ammirati F, Castro A, Pandozi C, Santini M,
Eur Heart J 18(10):1632-4161, 1997

[NA] **Influence of D-net (European GSM -Standard) cellular phones on pacemaker function in 50 patients with permanent pacemakers.** VIEW
Wilke A, Grimm W, Funck R, Maisch B
Pacing Clin Electrophysiol 19(10):1456-1458, 1996

[NA] **Inhibited head movements: A risk of combining phoning with other activities** VIEW
Oommen BS, Stahl JS.
Neurology. Jul 6 2005

[NA] **Inhibition of temporary pacing by a mobile phone.** VIEW
Betts TR, Simpson IA
Heart 87:130, 2002

[NA] **Interference of cellular phones with implanted permanent pacemakers** VIEW
Chen WH, Lau CP, Leung SK, Ho DS, Lee IS
Clin Cardiol 19(11):881-886, 1996

[NA] **Interference with cardiac pacemakers by cellular telephones** VIEW
Hayes DL, Wang PJ, Reynolds DW, Estes M 3rd, Griffith JL, Steffens RA, Carlo GL, Findlay GK, Johnson CM
N Engl J Med 336(21):1473-1479, 1997

[NA] **Intermittent pacemaker dysfunction caused by digital mobile telephones** VIEW
Naegeli B, Osswald S, Deola M, Burkart F
J Am Coll Cardiol 27(6):1471-1477, 1996

[NA] **Is there a risk for interaction between mobile phones and single lead VDD pacemakers?** VIEW
Nowak B, Rosocha S, Zellerhoff C, Liebrich A, Himmrich E, Voigtlander T, Meyer J
Pacing Clin Electrophysiol 19(10):1447-1450, 1996

[NA] **Lifesavers and cellular samaritans: emergency use of cellular (mobile) phones in Australia.** VIEW
Chapman S, Schofield B.
Accident Analysis and Prevention 1998;30:815-9. 1998

[NA] **Microwave absorption by magnetite: a possible mechanism for coupling nonthermal levels of radiation to biological systems.** VIEW
Kirschvink JL,
Bioelectromagnetics 17(3):187-194, 1996

[NA] **Miniplate osteosynthesis and cellular phone create disturbance of infraorbital nerve.** VIEW
Westermark A, Wisten A.
J Craniofac Surg 12(5):475-478, 2001

[NA] **Mobile phone use and exposures in children.** VIEW
Schuz J.
Bioelectromagnetics. Sep 2; 2005

[NA] **Mobile phones, heat shock proteins and cancer** VIEW
French PW, Penny R, Laurence JA,McKenzie DR
Differentiation (2001) 67 (4-5), 93-97. 2001

[NA] **Mobile phones, web chat, and sex among Norwegian adolescents** VIEW
Pedersen W
Tidsskr Nor Laegeforen. 124(13-14):1756-1759, 2004

[NA] **Modeling of the effect of modulated electromagnetic radiation on animal cells** VIEW
Gapeev AB, Chemeris NK,
Biofizika 45(2):299-312, 2000

[NA] **Neurological abnormalities associated with CDMA exposure.** VIEW
Hocking B, Westerman R
Occup Med (Lond) 51(6):410-413, 2001

[NA] **Parotid nodular fasciitis in a mobile phone user.** VIEW
Pereira C, Edwards M,
J Laryngol Otol 114(11):886-887, 2000

[NA] **Possible electromagnetic interference with electronic medical equipment by radio waves coming from outside the hospital.** VIEW
Hanada E, Kodama K, Takano K, Watanabe Y, Nose Y
J Med Syst 25(4):257-267, 2001

[NA] **Radiofrequency (RF) sickness in the Lilienfeld Study: an effect of modulated microwaves?** VIEW
Johnson Liakouris AG
Arch Environ Health 53(3):236-238, 1998

[NA] **Reliability of electromagnetic filters of cardiac pacemakers tested by cellular telephone ringing.** VIEW
Trigano A, Blandeau O, Dale C, Wong MF, Wiart J.
Heart Rhythm. 2(8):837-841, 2005

[NA] **Role of mobile phones in motor vehicle crashes resulting in hospital attendance: a case-crossover study.** VIEW
McEvoy SP, Stevenson MR, McCartt AT, Woodward M, Haworth C, Palamara P, Cercarelli R
BMJ. Jul 12; 2005

[NA] **Selected parameters of circulatory system function in various occupational groups exposed to HF EMF** VIEW
Zmyslony M, Bortkiewicz A, Aniolczyk H,
Med Pr 47(1):9-14, 1996

[NA] **Selective treatment of neoplastic cells using ferritin-mediated electromagnetic hyperthermia.** VIEW
Babincova M, Leszczynska D, Sourivong P, Babinec P
Med Hypotheses 54(2):177-179, 2000

[NA] **The absence of interference between GSM mobile telephones and implantable defibrillators: an in-vivo study. Groupe Systemes Mobiles** VIEW
Sanmartin M, Fernandez Lozano I, Marquez J, Antorrena I, Bautista A, Silva L, Ortigosa J, de Artaza M
Rev Esp Cardiol 50(10):715-719, 1997

[NA] **The effect of electromagnetic interference from mobile communication on the performance of intensive care ventilators.** VIEW
Jones RP, Conway DH.
Eur J Anaesthesiol. 22(8):578-583, 2005

[NA] **The safety of digital mobile cellular telephones with minute ventilation rate adaptive pacemakers.** VIEW
Sparks PB, Mond HG, Joyner KH, Wood MP
Pacing Clin Electrophysiol 19(10):1451-1455, 1996

[NA] **Use of mobile phones in ICU--why not ban?** VIEW
Yeolekar ME, Sharma A.
J Assoc Physicians India. 52:311-313, 2004

[NA] **Wireless Technology Research (WTR), LLC overview** VIEW
Motorola public relations
In this document only 1999

[Y] **Angiosarcoma of the scalp and use of a cordless (portable) telephone.** VIEW
Hardell L, Reizenstein J, Johansson B, Gertzen H, Mild KH
Epidemiology 10(6):785-786, 1999

[Y] **Brain cancer with induction periods of less than 10 years in young military radar workers** VIEW
Richter ED, Berman T, Levy O
Arch Environ Health 57(4):270-272, 2002

[Y] **Cerebral symptoms from mobile telephones.** VIEW
Cox RA, Luxton LM,
Occup Environ Med (letter to the editor) 57(6):431, 2000

[Y] **Clastogenic effects of radiofrequency radiations on chromosomes of Tradescantia.** VIEW
Haider T, Knasmueller S, Kundi M, Haider M,
Mutat Res 324(1-2):65-68, 1994

[Y] **Cytogenetic changes induced by low-intensity microwaves in the species Triticum aestivum** VIEW
Pavel A, Ungureanu CE, Bara II, Gassner P, Creanga DE,
Rev Med Chir Soc Med Nat Iasi 102(3-4):89-92, 1998

[Y] **Dermatitis caused by radio-frequency electromagnetic radiation** VIEW
Strobos MA, Coenraads PJ, De Jongste MJ, Ubels FL
Contact Dermatitis 44(5):309, 2001

[Y] **Distractions and the risk of car crash injury: the effect of drivers' age.** VIEW
Lam LT
J Safety Res 33(3):411-419, 2002

[Y] **Effects of mobile phone emissions on human brain activity and sleep variables.** VIEW
Hamblin DL, Wood AW
Int J Radiat Biol 78(8):659-669, 2002

[Y] **Influence of 400, 900, and 1900 MHz electromagnetic fields on Lemna minor growth and peroxidase activity.** VIEW
Tkalec M, Malaric K, Pevalek-Kozlina B.
Bioelectromagnetics. 26(3):185-193, 2005

[Y] **Neurological abnormalities associated with Mobile phone use** VIEW
Hocking B, Westerman R,
Occup Med 50: 366-368, 2000

[Y] **Perturbations of plant leaflet rhythms caused by electromagnetic radio-frequency radiation.** VIEW
Ellingsrud S, Johnsson A
Bioelectromagnetics 14(3):257-271, 1993

[Y] **Phasic behavioral and endocrine effects of microwaves of nonthermal intensity** VIEW
Navakatikian MA, Tomashevskaya LA,
In "Biological Effects of Electric and Magnetic Fields, Volume 1" D.O. Carpenter (ed) Academic Press, San Diego, CA, 1994, pp. 333-342. 1994

[Y] **Plant sensitivity to low intensity 105 GHz electromagnetic radiation.** VIEW
Tafforeau M, Verdus MC, Norris V, White GJ, Cole M, Demarty M, Thellier M, Ripoll C.
Bioelectromagnetics. 25(6):403-407, 2004

[Y] **Research on the neurological effects of nonionizing radiation at the University of Washington.** VIEW
Lai H,
Bioelectromagnetics. 13(6). P 513-26. 1992

[Y] **Role of modulation in biological effects of electromagnetic radiation** VIEW
Grigor'ev IuG
Radiats Biol Radioecol 36(5):659-670, 1996

[Y] **SIMS study of the calcium-deprivation step related to epidermal meristem production induced in flax by cold shock or radiation from a GSM telephone.** VIEW
Tafforeau M, Verdus M-C, Norris V, White G, Demarty M, Thellier M, Ripoll C.
J Trace Microprobe Tech 20(4):611-623, 2002

[Y] **Subjective symptoms reported by people living in the vicinity of cellular phone base stations** VIEW
Bortkiewicz A, Zmyslony M, Szyjkowska A, Gadzicka E
Med Pr. 55(4):345-351, 2004

[Y] **Visual abnormalities associated with high-energy microwave exposure** VIEW
Lim JI, Fine SL, Kues HA, Johnson MA.
Retina 13(3):230-233, 1993

50-60 Hz (13)

[N] **Association Of Health Problems With 50 -Hz Magnetic Fields In Human Adults Living Near Power Transmission Lines** VIEW
Beale I, Pearce NE, Booth RJ, Heriot SA
Journal of the Australasian College of Nutritional & Environmental Mediciine, Vol. 20 No.2 August 2001 **NOTE: 50/60 Hz study**

[N] **Biological effects of non-ionizing electromagnetic energy:** VIEW
Havas M
Environ Rev. 8: 173-253 Dossiers Environ. 2001 **NOTE: 50/60 Hz study**

[Y] **60 Hz Magnetic fields and Central Cholinergic Activity: Effects of Exposure Intensity and Duration.** VIEW
Lai H, Carino MA
Bioelectromagnetics (In press) 1998 **NOTE: 50/60 Hz study**

[Y] **A pooled analysis of magnetic fields, wire codes and childhood leukemia** VIEW
Greenland S, Sheppard AR, Kaune WT, Poole C, Kelsh MA
Epidemiology, October 2000, Volume 11, Number 6 2000 **NOTE: 50/60 Hz study**

[Y] **Cytogenetic effects of 50 Hz magnetic fields of different magnetic flux densities.** VIEW
Maes A, Collier M, Vandoninck S, Scarpa P, Verschaeve L,
Bioelectromagnetics 21(8):589-596, 2000 **NOTE: 50/60 Hz study**

[Y] **Effect of electromagnetic field exposure on chemically induced differentiation of friend erythroleukemia cells** VIEW
Chen G, Upham BL, Sun W, Chang CC, Rothwell EJ, Chen KM, Yamasaki H, Trosko JE
Environ Health Perspect 2000 Oct;108(10):967-72 2000 **NOTE: 50/60 Hz study**

[Y] **Effects of co-exposure to ELF magnetic fields and benzene or benzene metabolites determined in vitro by the alkaline comet assay** VIEW
Morettia M, Villarinia, Simonuccib S, Fatigonia C, Scassellati-Sforzolinia G, Monarcaa S, Pasquinia R, Angeluccic M, Strappinic M
Elsevier Ireland Ltd 21 January 2005 **NOTE: 50/60 Hz study**

[Y] **Hematopoietic neoplasia in C57BL/6 mice exposed to split-dose ionizing radiation and circularly polarized 60 Hz magnetic fields.** VIEW
Babbitt JT, Kharazi AI, Taylor JM, Bonds CB, Mirell SG, Frumkin E, Zhuang D, Hahn TJ
Carcinogenesis 2000 Jul;21(7):1379-89 2000 **NOTE: 50/60 Hz study**

[Y] **Historical evidence that residential electrification caused the emergence of the childhood leukemia peak** VIEW
Milham S, Ossiander EM
Medical Hypotheses, Harcourt Publishers Ltd, April 2001 **NOTE: 50/60 Hz study**

[Y] **Intracerebroventricular injection of mu- and delta-opiate receptor antagonists block 60 Hz magnetic field-induced decreases in cholinergic activity in the frontal cortex and hippocampus of the rat.** VIEW
Lai H, Carino MA
Bioelectromagnetics. 1998. 19(7). P 432-7. 1998 **NOTE: 50/60 Hz study**

[Y] **Primary brain tumor incidence in mice exposed to split-dose ionizing radiation and circularly polarized 60 Hz magnetic fields.** VIEW
Kharazi AI, Babbitt JT, Hahn TJ
Cancer Lett 1999 Dec 1;147(1-2):149-56 1999 **NOTE: 50/60 Hz study**

[Y] **Spatial learning deficit in the rat after exposure to a 60 Hz magnetic field.** VIEW
Lai H
Bioelectromagnetics. 1996. 17(6). P 494-6. 1996 **NOTE: 50/60 Hz study**

[Y] **The effect of 50 Hz magnetic field on GCSmRNA expression in lymphoma B cell by mRNA differential display.** VIEW
Wu RY, Chiang H, Hu GL, Zeng QL, Bao JL
J Cell Biochem Dec 1;79(3):460-470 2000 **NOTE: 50/60 Hz study**

Source of Funding and Results of Studies of Health Effects of Mobile Phone Use: Systematic Review of Experimental Studies

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Objectives: There is concern regarding the possible health effects of cellular telephone use. We examined whether the source of funding of studies of the effects of low-level radiofrequency radiation is associated with the results of studies. We conducted a systematic review of studies of controlled exposure to radiofrequency radiation with health-related outcomes (electroencephalogram, cognitive or cardiovascular function, hormone levels, symptoms, and subjective well-being).

Data sources: We searched EMBASE, Medline, and a specialist database in February 2005 and scrutinized reference lists from relevant publications.

Data extraction: Data on the source of funding, study design, methodologic quality, and other study characteristics were extracted. The primary outcome was the reporting of at least one statistically significant association between the exposure and a health-related outcome. Data were analyzed using logistic regression models.

Data synthesis: Of 59 studies, 12 (20%) were funded exclusively by the telecommunications industry, 11 (19%) were funded by public agencies or charities, 14 (24%) had mixed funding (including industry), and in 22 (37%) the source of funding was not reported. Studies funded exclusively by industry reported the largest number of outcomes, but were least likely to report a statistically significant result: The odds ratio was 0.11 (95% confidence interval, 0.02–0.78), compared with studies funded by public agencies or charities. This finding was not materially altered in analyses adjusted for the number of outcomes reported, study quality, and other factors.

Conclusions: The interpretation of results from studies of health effects of radiofrequency radiation should take sponsorship into account.

Key words: electromagnetic fields, financial conflicts of interest, human laboratory studies, mobile phones. *Environ Health Perspect* 115:1–4 (2007). doi:10.1289/ehp.9149 available via *http://dx.doi.org/* [Online 15 September 2006]

The use of mobile telephones has increased rapidly in recent years. The emission of low-level radiofrequency electromagnetic fields leading to the absorption of radiation by the brain in users of handheld mobile phones has raised concerns regarding potential effects on health (Rothman 2000). However, the studies examining this issue have produced conflicting results, and there is ongoing debate on this issue (Ahlbom et al. 2004; Feychting et al. 2005). Many of the relevant studies have been funded by the telecommunications industry, and thus may have resulted in conflicts of interest (Thompson 1993). Recent systematic reviews of the influence of financial interests in medical research concluded that there is a strong association between industry sponsorship and pro-industry conclusions (Bekelman et al. 2003; Yaphe et al. 2001). This association has not been examined in the context of the studies of potential adverse effects of mobile phone use. We performed a systematic review and analysis of the literature to examine whether industry involvement is associated with the results and methodologic quality of studies.

Methods

We searched EMBASE (http://www.embase.com) and Medline (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed) in February 2005. Key and free text words included "cell(ular)," "mobile," "(tele)phone(s)" in connection with "attention," "auditory," "bioelectric," "brain physiology," "cardiovascular," "cerebral," "circulatory," "cognitive," "EEG," "health complaint(s)," "hearing," "heart rate," "hormone(s)," "learning," "melatonin," "memory," "neural," "neurological," "nervous system," "reaction," "visual," "symptom(s)," or "well-being." The search was complemented with references from a specialist database (ELMAR 2005) and by scrutinizing reference lists from the relevant publications. Articles published in English, German, or French were considered.

We included original articles that reported studies of the effect of controlled exposure with radiofrequency radiation on health-related outcomes ["human laboratory studies" in World Health Organization (WHO) terminology (Repacholi 1998)]. Health-related outcomes included electroencephalogram (EEG) recordings, assessments of cognitive or cardiovascular function, hormone levels, and subjective well-being and symptoms. We excluded studies of the risk of using mobile phones when driving a motor vehicle or operating machinery as well as studies on electromagnetic field (EMF) incompatibilities (e.g., pacemakers or hearing aids). Three of us (A.H., K.H., M.R.) independently extracted data on the source of funding (industry, public or charity, mixed, not reported) and potential confounding factors, including study design (crossover, parallel, other), exposure (frequency band, duration, field intensity, and location of antenna), and methodologic and reporting quality. Four dimensions of quality were assessed (Jüni et al. 2001; Repacholi 1998): *a*) randomized, concealed allocation of study participants in parallel or crossover trials; *b*) blinding of participants and investigators to allocation group; *c*) reporting of the specific absorption rate (SAR; watts per kilogram tissue) from direct measurement using a phantom head or three-dimensional dosimetric calculations ("appropriate exposure setting"); *d*) appropriate statistical analysis. For each item, studies were classified as adequate or inadequate/unclear.

The primary outcome was the reporting of at least one statistically significant ($p < 0.05$) association between radiofrequency exposure and a health-related outcome. The message in the title was also assessed. We distinguished among neutral titles [e.g., "Human brain activity during exposure to radiofrequency fields emitted by cellular phones" (Hietanen et al. 2000)], titles indicating an effect of radiation [e.g., "Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG" (Huber et al. 2000)], and titles stating that no effect was shown [e.g., "No effect on cognitive function from daily mobile phone use" (Besset et al. 2005)]. Finally, authors' declaration of conflicts of interest (present, absent) and affiliations (industry, other) were recorded. Differences in data extracted by A.H., K.H., and M.R. were resolved in the group, with the senior epidemiologist (M.R.) acting as the arbiter. In addition, two of us (K.H.M., M.E.), who were kept blind to funding

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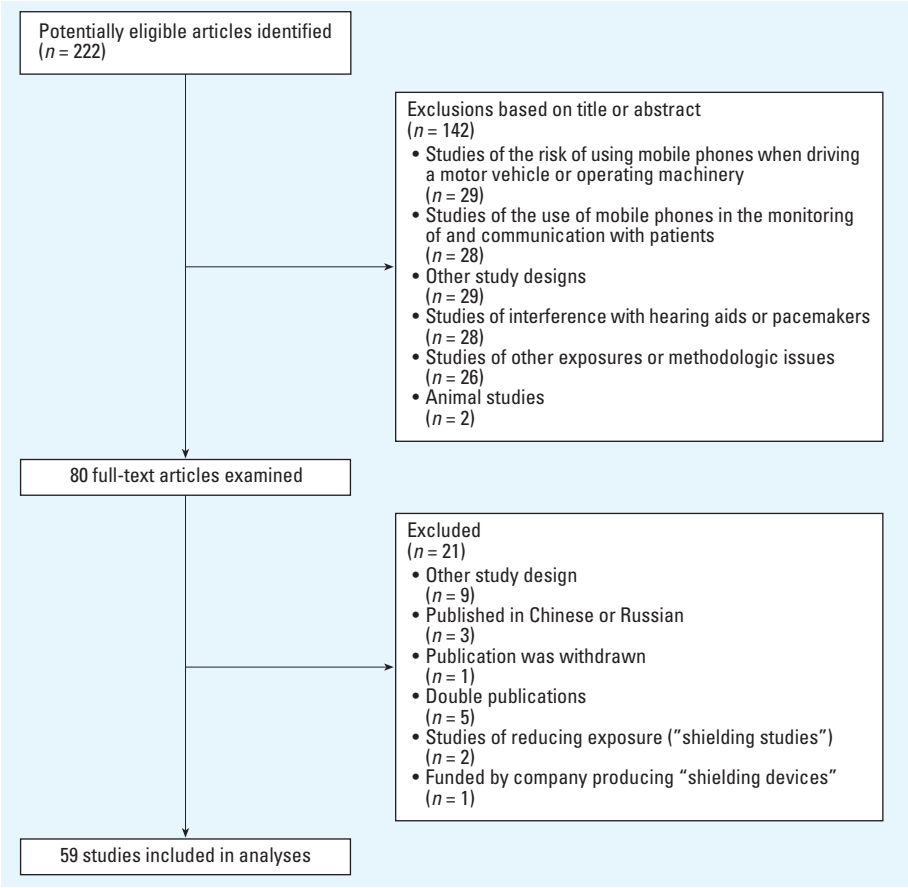

Figure 1. Identification of eligible studies.

Table 1. Characteristics of 59 experimental studies of the effects of exposure to low-level radiofrequency electromagnetic fields.

	Source of funding			
Study characteristic	Industry (*n* = 12)	Public or charity (*n* = 11)	Mixed (*n* = 14)	Not reported (*n* = 22)
Study design [no. (%)]				
Crossover trial	10 (83.3)	7 (63.6)	12 (85.7)	11 (50)
Parallel group trial	0 (0)	2 (18.2)	1 (7.1)	2 (9.1)
Other, unclear	2 (16.7)	2 (18.2)	1 (7.1)	9 (40.9)
Exposure [no. (%)]				
Location of antenna				
Next to ear	4 (33.3)	8 (72.7)	11 (78.6)	14 (63.6)
Other/unclear	8 (66.7)	3 (27.3)	3 (21.4)	8 (36.4)
Frequency band[a]				
900 MHz	11 (91.7)	8 (72.7)	13 (92.9)	14 (63.6)
Other frequencies	2 (16.7)	7 (63.6)	0 (0)	5 (22.7)
Unclear	0 (0)	0 (0)	1 (7.1)	5 (22.7)
Median duration of exposure (range)	180 (3–480)	20 (5–35)	45 (30–240)	30 (4–480)
Outcomes assessed [no. (%)][a]				
Electroencephalogram	7 (58.3)	5 (45.5)	8 (57.1)	12 (54.5)
Cognitive function tests	0 (0)	3 (27.3)	8 (57.1)	8 (36.4)
Hormone levels	5 (41.7)	0 (0)	0 (0)	2 (9.1)
Cardiovascular function	2 (16.7)	1 (9.1)	0 (0)	2 (9.1)
Well-being or symptoms	1 (8.3)	1 (9.1)	1 (7.1)	0 (0)
Other	4 (33.3)	3 (27.3)	1 (7.1)	3 (13.6)
Study quality [no. (%)][a]				
Randomization adequate	10 (83.3)	7 (63.6)	13 (92.9)	9 (40.9)
Participants and assessors blinded	1 (8.3)	3 (27.3)	8 (57.1)	3 (13.6)
SAR determined	4 (33.3)	4 (36.4)	8 (57.1)	2 (9.1)
Statistical analysis adequate	3 (25)	3 (27.3)	7 (50)	1 (4.5)
Median study size (range)	21 (8–38)	24 (13–100)	20 (13–96)	20 (8–78)

Percentages are column percentages.
[a]The same study could be listed in more than one category.

source, authors, and institutions, repeated extraction of data from abstracts and assessments of titles. Differences in data extracted by K.H.M. and M.E. were resolved with the senior epidemiologist (M.E.) acting as the arbiter. Based on the abstracts, we assessed whether authors interpreted their study results as showing an effect of low-level radiofrequency radiation, as showing no effect, or as indicating an unclear finding.

We used logistic regression models to assess whether the source of funding was associated with the reporting of at least one significant effect in the article (including the abstract). We examined the influence of potential confounders, such as the total number of outcomes that were reported in the article, the type of study (crossover, parallel, other), the four dimensions of study quality (adequate or not adequate/unclear), exposure conditions (position of the antenna next to the ear compared with other locations; use of the 900-MHz band compared with other bands; duration of exposure in minutes), as well as the type of outcome (e.g., cognitive function tests: yes vs. no). Variables were entered one at a time and, given the limited number of studies, models were adjusted for one variable only. Results are reported as odds ratios (ORs) with 95% confidence intervals (CIs). All analyses were carried out in Stata (version 8.2; StataCorp., College Station, TX, USA).

Results

We identified 222 potentially relevant publications and excluded 163 studies that did not meet inclusion criteria (Figure 1). We excluded one study that had been funded by a company producing "shielding" devices that reduce EMF exposure (Croft et al. 2002). A total of 59 studies were included: 12 (20%) were exclusively funded by the telecommunications industry, 11 (19%) were funded by public agencies or charities, 14 (24%) had mixed funding (including industry and industry-independent sources), and in 22 (37%) studies the source of funding was not reported. None of 31 journals published a statement on possible conflicts of interest of the 287 authors listed in the bylines. Five (8%) studies had authors with industry affiliation. All studies except two (3%) were published in journals that use peer review, and one was published in a journal supplement. The bibliographic references are given in the Supplemental Material (http://www.ehponline.org/members/2006/9149/supplemental.pdf).

Blinded and open extraction of data yielded identical results with respect to the reporting of statistically significant effects in the abstract and the message of the title. Study characteristics are shown in Table 1. All studies were published during 1995–2005, with the number of publications increasing from one to

two publications per year to 11 publications in 2004. Median year of publication was 1998 for industry-funded studies, 2002 for public or charity funding and studies with mixed funding sources, and 2003 for studies that did not report their funding source. The median size of all the studies was small (20 study participants); most studies (n = 32, 54%) were of a crossover design and mimicked the exposure situation during a phone call, using the 900-MHz band with the antenna located close to the ear. Exposure duration ranged from 3 to 480 min, with a median of 33 minutes. Thirty-three (59%) studies measured outcomes during exposure, 14 (24%) postexposure, and 12 (20%) at both times. Thirty-nine (66%) studies prevented selection bias with adequate randomization; 15 (25%) blinded both participants and assessors; in 18 (31%) the field intensity had been assessed appropriately, with SAR values ranging from 0.03 to 2 W/kg tissue. Finally, in 14 (24%) studies we considered the statistical analysis to be adequate. Study quality varied by source of funding: Studies with mixed funding (including public agencies or charities and industry) had the highest quality, whereas studies with no reported source of funding did worst (Table 1).

Forty (68%) studies reported one or more statistically significant results ($p < 0.05$) indicating an effect of the exposure (Table 2). Studies funded exclusively by industry reported on the largest number of outcomes but were less likely to report statistically significant results: The OR for reporting at least one such result was 0.11 (95% CI, 0.02–0.78), compared with studies funded by public agencies or charities (Table 3). This finding was not materially altered in analyses adjusted for the number of outcomes reported, study design and quality, exposure characteristics, or outcomes [Table 3; see Supplemental Material, Table 1 (http://www.ehponline.org/members/2006/9149/supplemental.pdf)]. Similar results were obtained when restricting analyses to results reported in abstracts (OR = 0.29; 95% CI, 0.05–1.59) or on the conclusions in the abstract (OR = 0.10, 95% CI, 0.009–1.10). Thirty-seven (63%) studies had a neutral title, 11 (19%) a title reporting an effect, and 11 (19%) a title reporting no effect (Table 2).

Discussion

We examined the methodologic quality and results of experimental studies investigating the effects of the type of radiofrequency radiation emitted by handheld cellular telephones. We hypothesized that studies would be less likely to show an effect of the exposure if funded by the telecommunications industry, which has a vested interest in portraying the use of mobile phones as safe. We found that the studies funded exclusively by industry were indeed substantially less likely to report statistically significant effects on a range of end points that may be relevant to health.

Our findings add to the existing evidence that single-source sponsorship is associated with outcomes that favor the sponsors' products (Bekelman et al. 2003; Davidson 1986; Lexchin et al. 2003; Stelfox et al. 1998). Most previous studies of this issue were based on studies of the efficacy and cost-effectiveness of drug treatments. A recent systematic review and meta-analysis showed that studies sponsored by the pharmaceutical industry were approximately four times more likely to have outcomes favoring the sponsor's drug than studies with other sources of funding (Lexchin et al. 2003). The influence of the tobacco industry on the research it funded has also been investigated (Barnes and Bero 1996, 1998; Bero 2005). To our knowledge, this is the first study to examine this issue in the context of exposure to radiofrequency electromagnetic fields.

Our study has several limitations. We restricted our analysis to human laboratory studies. This resulted in a more homogenous set of studies, but may have reduced the statistical power to demonstrate or exclude smaller associations. The WHO has identified the need for further studies of this type to clarify the effects of radiofrequency exposure on neuroendocrine, neurologic, and immune systems (Foster and Repacholi 2004). We considered including epidemiologic studies but found that practically all of them were publicly funded. The study's primary outcome—the reporting of statistically significant associations—is a crude measure that ignores the size of reported effects. However, we found the same trends when assessing the authors' conclusions in the abstracts.

Although we have shown an association between sponsorship and results, it remains unclear which type of funding leads to the most accurate estimates of the effects of

Table 2. Results from assessments of article text, abstract, and title of 59 experimental studies of the effects of exposure to low-level radiofrequency electromagnetic fields.

	Source of funding			
	Industry (n = 12)	Public or charity (n = 11)	Mixed (n = 14)	Not reported (n = 22)
Article text				
No. (%) of studies with at least one result suggesting an effect at $p < 0.05$	4 (33)	9 (82)	10 (71)	17 (77)
Median no. (range) of outcomes reported	17.5 (4–31)	10 (1–80)	16 (9–44)	7 (1–35)
Median no. (range) of outcomes suggesting an effect at $p < 0.05$	0 (0–6)	1.5 (0–7)	3 (0–15)	1.5 (0–12)
Abstract[a]	(n = 12)	(n = 11)	(n = 14)	(n = 20)
No. (%) of studies with at least one result suggesting a significant effect	4 (33)	7 (64)	10 (71)	15 (75)
Median no. (range) of outcomes reported	3.5 (1–36)	3 (1–5)	6.5 (3–44)	3 (1–64)
Median no. (range) of outcomes suggesting a significant effect	0 (0–6)	1 (0–3)	2 (0–5)	1.5 (0–7)
Authors' interpretation of results [no. (%)]				
No effect of radiofrequency radiation	10 (83.3)	5 (45.5)	4 (28.6)	5 (22.7)
Effect of radiofrequency radiation	1 (8.3)	5 (45.5)	8 (57.1)	14 (63.6)
Unclear finding	1 (8.3)	1 (9)	2 (14.3)	3 (13.6)
Title [no. (%)]				
Neutral	7 (58)	5 (46)	8 (57)	17 (77)
Statement of effect	0 (0)	4 (36)	3 (21)	4 (18)
Statement of no effect	5 (42)	2 (18)	3 (21)	1 (5)

Percentages are column percentages.
[a]Two publications that did not report their source of funding had no abstracts.

Table 3. Probability of reporting at least one statistically significant result ($p < 0.05$) according to source of funding: crude and adjusted ORs (95% CIs) from logistic regression models.

	Source of funding				
	Industry (n = 12)	Public or charity (n = 11)	Mixed (n = 14)	Not reported (n = 22)	p-Value[a]
Crude	0.11 (0.02–0.78)	1 (reference)	0.56 (0.08–3.80)	0.76 (0.12–4.70)	0.04
Adjusted for					
No. of reported outcomes	0.12 (0.02–0.89)	1 (reference)	0.60 (0.08–4.28)	0.96 (0.15–6.23)	0.04
Median study size	0.08 (0.009–0.62)	1 (reference)	0.61 (0.08–4.59)	0.57 (0.08–4.02)	0.02
Study design (crossover, parallel, or other)	0.08 (0.01–0.68)	1 (reference)	0.38 (0.05–3.07)	1.16 (0.16–8.61)	0.029
Study quality					
Randomization adequate	0.04 (0–0.56)	1 (reference)	0.16 (0.01–2.15)	1.27 (0.16–9.89)	0.005
Participants and assessors blinded	0.14 (0.02–0.96)	1 (reference)	0.54 (0.08–3.91)	0.76 (0.12–4.8)	0.09
Statistical analysis adequate	0.12 (0.02–0.85)	1 (reference)	0.67 (0.09–4.85)	0.54 (0.08–3.76)	0.07
Exposure setting appropriate	0.13 (0.02–0.89)	1 (reference)	0.47 (0.07–3.39)	0.86 (0.14–5.5)	0.06

Models adjusted for one variable at a time.
[a]From likelihood ratio tests.

radiofrequency radiation. For example, if researchers with an environmentalist agenda are more likely to be funded by public agencies or charities, then their bias may result in an overestimation of effects. Interestingly, studies with mixed funding were of the highest quality. The National Radiological Protection Board (NRPB 2004) reviewed studies of health effects from radiofrequency (RF) fields and concluded that "scientific evidence regarding effects of RF field exposure from mobile phones on human brain activity and cognitive function … has included results both supporting and against the hypothesis of an effect." We found that the source of funding explains some of the heterogeneity in the results from different studies. The association was robust and little affected by potential confounding factors such as sample size, study design, or quality.

Possible explanations for the association between source of funding and results have been discussed in the context of clinical research sponsored by the pharmaceutical industry (Baker et al. 2003; Bekelman et al. 2003; Lexchin et al. 2003). The association could reflect the selective publication of studies that produced results that fitted the sponsor's agenda. Sponsors might influence the design of the study, the nature of the exposure, and the type of outcomes assessed. In multivariate logistic regression analysis, the only factor that strongly predicted the reporting of statistically significant effects was whether or not the study was funded exclusively by industry. We stress that our ability to control for potential confounding factors may have been hampered by the incomplete reporting of relevant study characteristics.

Medical and science journals are implementing policies that require authors to disclose their financial and other conflicts of interest. None of the articles examined here included such a statement, in line with a survey of science and medical journals that showed that adopting such policies does not generally lead to the publication of disclosure statements (Krimsky and Rothenberg 2001). A review of 2005 instructions to authors showed that 15 (48%) of the 31 journals included in our study had conflict of interest policies. Our results support the notion that disclosure statements should be published, including statements indicating the absence of conflicts of interest. The role of the funding source in the design, conduct, analysis, and reporting of the study should also be addressed.

There is widespread concern regarding the possible health effects associated with the use of cellular phones, mobile telephone base stations, or broadcasting transmitters. Most (68%) of the studies assessed here reported biologic effects. At present it is unclear whether these biologic effects translate into relevant health hazards. Reports from national and international bodies have recently concluded that further research efforts are needed, and dedicated research programs have been set up in the United States, Germany, Denmark, Hungary, Switzerland, and Japan. Our study indicates that the interpretation of the results from existing and future studies of the health effects of radiofrequency radiation should take sponsorship into account.

References

Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A. 2004. Epidemiology of health effects of radiofrequency exposure. Environ Health Perspect 112:1741–1754.

Baker C, Johnsrud M, Crismon M, Rosenheck R, Woods S. 2003. Quantitative analysis of sponsorship bias in economic studies of antidepressants. Br J Psychiatry 183:498–506.

Barnes D, Bero L. 1996. Industry-funded research and conflict of interest: an analysis of research sponsored by the tobacco industry through the center for indoor air research. J Health Polit Policy Law 21:515–542.

Barnes D, Bero L. 1998. Why review articles on the health effects of passive smoking reach different conclusions. JAMA 279:1566–1570.

Bekelman JE, Li Y, Gross CP. 2003. Scope and impact of financial conflicts of interest in biomedical research: a systematic review. JAMA 289:454–465.

Bero L. 2005. Tobacco industry manipulation of research. Public Health Rep 120:200–208.

Besset A, Espa F, Dauvilliers Y, Billiard M, de Seze R. 2005. No effect on cognitive function from daily mobile phone use. Bioelectromagnetics 26:102–108.

Croft RJ, Chandler JS, Burgess AP, Barry RJ, Williams JD, Clarke AR. 2002. Acute mobile phone operation affects neural function in humans. Clin Neurophysiol 113:1623–1632.

Davidson R. 1986. Source of funding and outcome of clinical trials. J Gen Intern Med 1:155–158.

ELMAR. 2005. Dokumentationsstelle ELMAR, Elektromagnetische Strahlung und Gesundheit. Available: www.elmar.unibas.ch [accessed 10 February 2005].

Feychting M, Ahlbom A, Kheifets L. 2005. EMF and health. Annu Rev Public Health 26:165–189.

Foster KR, Repacholi MH. 2004. Biological effects of radiofrequency fields: does modulation matter? Radiat Res 162:219–225.

Hietanen M, Kovala T, Hamalainen AM. 2000. Human brain activity during exposure to radiofrequency fields emitted by cellular phones. Scand J Work Environ Health 26:87–92.

Huber R, Graf T, Cote KA, Wittmann L, Gallmann E, Matter D, et al. 2000. Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG. Neuroreport 11:3321–3325.

Jüni P, Altman DG, Egger M. 2001. Systematic reviews in health care: assessing the quality of controlled clinical trials. BMJ 323:42–46.

Krimsky S, Rothenberg L. 2001. Conflict of interest policies in science and medical journals: Editorial practices and author disclosures. Sci Eng Ethics 7:205–218.

Lexchin J, Bero LA, Djulbegovic B, Clark O. 2003. Pharmaceutical industry sponsorship and research outcome and quality: Systematic review. BMJ 326:1167–1170.

NRPB (National Radiological Protection Board). 2004. Health effects from radiofrequency electromagnetic fields. Report of an independent advisory group on non-ionising radiation. Documents of the NRPB 14(2):1–177. Available: http://www.hpa.org.uk/radiation/publications/documents_of_nrpb/pdfs/doc_14_2.pdf [accessed 3 July 2006].

Repacholi MH. 1998. Low-level exposure to radiofrequency electromagnetic fields: health effects and research needs. Bioelectromagnetics 19:1–19.

Rothman KJ. 2000. Epidemiological evidence on health risks of cellular telephones. Lancet 356:1837–1840.

Stelfox H, Chua G, O'Rourke K, Detsky A. 1998. Conflict of interest in the debate over calcium-channel antagonists. N Engl J Med 338:101–106.

Thompson DF. 1993. Understanding financial conflicts of interest. N Engl J Med 329:573–576.

Yaphe J, Edman R, Knishkowy B, Herman J. 2001. The association between funding by commercial interests and study outcome in randomized controlled drug trials. Fam Pract 18:565–568.

L'affaire Repacholi : "Téléphonie mobile: trafic d'influence à l'OMS ?" - Agoravox - 26/01/2007

Opérateurs, fabricants de téléphones portables, pouvoirs publics : tout le monde, sans exception, se réfugie derrière les sacro-saintes recommandations de l'Organisation mondiale de la santé (OMS) en matière de rayonnement électromagnétique. Mais l'OMS est-elle vraiment si neutre et objective que cela ?

Noyautage, lobbying intensif, trafic d'influence, financement intéressé... : en juillet 2000, un comité d'experts indépendants mandaté par l'OMS publiait une bombe de 260 pages détaillant par le menu les sombres tactiques utilisées par les cigarettiers pour miner les campagnes antitabac de l'OMS. Au même moment, pour désamorcer le scandale, l'agence onusienne émettait 15 pages de recommandations afin qu'à l'avenir son travail ne soit plus jamais sapé de la sorte par des intérêts industriels. Mais aujourd'hui, l'OMS a-t-elle réellement tiré les leçons du passé ? De plus en plus de monde en doute.

Ces dernières années, l'étau de la suspicion s'est notamment resserré autour d'un homme qui, jusqu'il y a peu, détenait un pouvoir considérable. Si le nom de Mike Repacholi n'évoque rien pour le commun des mortels, il donne par contre de l'urticaire à de nombreux scientifiques ainsi qu'aux associations militant pour l'instauration de normes d'émissions électromagnétiques plus sévères.

Pétition et lettre ouverte

Physicien et docteur en biologie, Mike Repacholi a été ces dix dernières années le coordinateur du Projet international pour l'étude des champs électromagnétiques (ou « projet CEM »), lancé par l'OMS en 1996. Son rôle ? Celui de « supersecrétaire » chargé de coordonner des programmes de recherche dans le monde entier afin d'évaluer les éventuels risques sanitaires liés aux lignes à haute tension, antennes relais et autres GSM. Sur la base des résultats scientifiques obtenus, l'OMS émet alors des recommandations mondiales de santé publique.

Or les détracteurs de M. Repacholi lui reprochent d'avoir systématiquement évacué ou minimisé les études « dérangeantes » pour l'industrie, impliqué celle-ci dans le processus de décision, écarté des scientifiques de renom des groupes d'experts réunis par ses soins à l'OMS, mais aussi d'avoir été très timoré dans ses recommandations de santé publique et d'avoir fait financer « son » projet CEM en grande partie par les industriels de la téléphonie mobile. En caricaturant à peine, l'homme est accusé, ni plus ni moins, d'avoir pédalé pendant dix ans pour l'industrie.

Une pétition internationale a circulé, l'an dernier, pour réclamer sa tête. Sans résultat. En juillet dernier, sauvé par l'âge légal de la retraite, M. Repacholi a quitté l'agence onusienne par la petite porte. Ce qui n'a pas empêché six ONG françaises d'adresser, en octobre et en décembre derniers, deux lettres ouvertes à la direction générale de l'OMS pour qu'elle diligente au plus vite une enquête sur les agissements suspects de M. Repacholi durant son mandat.

Expert judiciaire pour l'industrie

« Le projet CEM était corrompu dès le départ, estime Andrew Marino, professeur de biologie cellulaire au Centre des sciences de la santé de l'université de Louisiane (Etats-Unis). Michael Repacholi était connu depuis plus de six ans comme consultant rémunéré et porte-voix des compagnies responsables de générer de la pollution électromagnétique. » Ce qui est sûr, c'est que M. Repacholi a été embauché par une compagnie d'électricité australienne, en 1990, pour témoigner comme expert en sa faveur dans un procès intenté par des fermiers de Nouvelle-Galles du Sud opposés à l'installation d'une ligne à haute tension sur leurs terres. Fin 1995, quelques mois avant de prendre la tête du projet CEM à l'OMS, M. Repacholi s'est à nouveau complaisamment prêté à ce petit jeu. Pour le compte de l'opérateur de téléphonie mobile néo-zélandais BellSouth, cette fois. Il s'agissait alors d'argumenter en faveur de l'opérateur contre des riverains de Christchurch opposés à l'implantation d'une antenne relais à 70 mètres d'une crèche...

Deux ans plus tard, M. Repacholi *« a également tout fait pour minimiser et étouffer les résultats fracassants d'une étude réalisée sur des souris transgéniques en Australie, se souvient Etienne Cendrier de l'association Robin des toits. Cette étude, réalisée en double aveugle, montrait un risque de tumeur doublé lorsque les souris étaient exposées deux heures par jour, durant 18 mois, au rayonnement d'un GSM. »* Ces souris, génétiquement modifiées pour développer facilement des tumeurs, sont couramment utilisées en recherche pour « gagner du temps », afin d'anticiper les effets d'un médicament ou d'un facteur environnemental qui, normalement, n'apparaîtraient qu'après de nombreuses années. Coordonnée par M. Repacholi dès 1993, cette recherche menée à l'Hôpital royal d'Adelaïde fut à l'époque financée par l'opérateur australien Telstra.

Selon le journaliste scientifique Stewart Fist, qui a suivi cette affaire de très près pour le quotidien The Australian, les coauteurs de cette étude explosive lui ont assuré à l'époque qu'elle avait été refusée par les prestigieuses revues scientifiques Nature et Science pour des raisons « politiques » - Science justifiant son refus en arguant qu'une telle publication « créerait la panique ». D'après M. Fist, ces revues de premier plan auraient toutes utilisé l'argument selon lequel les résultats devaient d'abord être répliqués. Le protocole de recherche était pourtant solidement ficelé et les résultats hautement significatifs sur le plan statistique ($p > 0.01$). Ce qui n'a pas empêché M. Repacholi de qualifier à plusieurs reprises ces résultats de « non concluants et insignifiants ».

De curieux revirements

Louis Slesin, chimiste physicien, docteur en sciences environnementales du MIT et rédacteur en chef de la lettre spécialisée Microwave News, blâme quant à lui M. Repacholi pour ses nombreux revirements au cours de son mandat. *« En février 2003, à Luxembourg, le coordinateur du projet CEM a annoncé qu'il existait désormais "suffisamment de preuves" pour préconiser des politiques préventives notamment en matière de rayonnements radiofréquence et micro-ondes (ceux de la téléphonie mobile, NDLR). Or, quelques semaines plus tard, il est revenu sur cette position sans la moindre justification. »*

Autre exemple ? A Ottawa, en juillet 2005, M. Repacholi déclare à la presse que « l'OMS recommande que les enfants utilisent des kits mains libres ». Mais peu après, il réaffirme une position antérieure de l'OMS selon laquelle *« les données scientifiques actuelles ne montrent aucun besoin de prendre la moindre précaution particulière en matière d'utilisation des téléphones portables »*.

Louis Slesin reproche également à M. Repacholi d'avoir favorisé l'industrie, en impliquant celle-ci dans la prise de décision au sein même de l'OMS. Le 3 octobre 2005, un groupe d'experts s'est réuni à Genève pour finaliser un document établissant des Critères de santé environnementale pour les champs électromagnétiques d'extrêmement basse fréquence. Louis Slesin a révélé que l'industrie avait « joué un rôle majeur à chaque étape du développement » de ce texte.

« Des documents montrent que Leeka Kheifets (alors collaboratrice de M. Repacholi, NDLR) a joué un rôle central dans la rédaction de l'avant-projet. » Or Mme Kheifets, professeure d'épidémiologie à l'université de Californie de Los Angeles, travaille depuis longtemps pour l'Institut de recherche de l'industrie électrique étasunienne (EPRI), même si son curriculum vitæ académique se garde bien de le mentionner. Il indique juste qu'en 1995 et 1996, elle a reçu le Performance Recognition Award décerné par l'EPRI. En 2005 pourtant, l'année même où Mme Kheifets a contribué à l'avant-projet de texte pour l'OMS, elle a dévoilé au journal Environmental Health Perspectives que l'EPRI avait financé ses travaux, et au British Medical Journal qu'elle travaille pour l'EPRI et qu'elle est consultante pour l'industrie électrique.

Selon Louis Slesin, Mme Kheifets a préparé l'avant-projet avec l'aide, entre autres, de trois représentants de cette même industrie. L'avant-projet a ensuite été envoyé à un grand nombre d'experts, comme cela se fait habituellement, afin de recueillir leurs commentaires. Parmi eux, cinq représentants de l'industrie électrique ont eu tout le loisir de remettre en question les passages gênants pour les intérêts du secteur qui les emploie.

Pas d'observateurs indépendants

Par ailleurs, le 3 octobre 2005 à Genève, lors de cette fameuse réunion du groupe d'experts (indépendants) chargés de finaliser les Critères de santé environnementale, huit représentants de l'industrie électrique ont été invités par M. Repacholi en tant qu'« observateurs ».

Aucun autre observateur (syndicat, association de consommateurs ou ONG écologiste, par exemple) n'a par contre été convié à cette réunion. *« Grâce à Repacholi, concluait Slesin en octobre 2005, l'industrie électrique a été et continue d'être un partenaire à part entière dans la rédaction de ce document - un texte qui sera la position officielle de l'OMS sur les champs électromagnétiques pour les années à venir. Le plus déconcertant, c'est que personne à l'OMS ne pense qu'il fait quoi que ce soit de mal. »*

Mais peut-être est-ce parce que l'OMS ne finance pas le projet CEM. En effet, M. Repacholi était contraint de réunir lui-même son budget de fonctionnement (tout comme Mme van Deventer aujourd'hui). Comme il l'a expliqué lors d'une réunion à Istanbul, en 2004, *« le projet CEM peut recevoir des fonds de n'importe quelle origine via l'Hôpital royal d'Adelaïde, un intermédiaire établi avec l'accord du département juridique de l'OMS en vue de rassembler les fonds pour le projet »*. Peut-on dès lors légitimement lui en vouloir d'être allé chercher l'argent là où il le trouvait, c'est-à-dire en grande partie chez les industriels du portable ? Une question à retourner à l'administration centrale de l'OMS et à son service juridique, qui ont autorisé ce curieux mécanisme de financement que Slesin n'hésite pas à assimiler à du « "blanchiment" » d'argent industriel.

Plus de 40% du budget financé par l'industrie du portable

Si officiellement le projet CEM *« est financé uniquement par des contributions extra-budgétaires venant des pays et agences participantes »*, il est établi qu'il reçoit chaque année - depuis 2005 en tout cas - plus de 150.000 $ du Mobile Manufacturers Forum (MMF), le lobby des fabricants de portables basé boulevard Reyers à Bruxelles. Contacté par le magazine belge Imagine, Michael Milligan, secrétaire général du MMF, se borne à rappeler que les versements se font *« en accord avec les demandes de l'OMS et via la procédure agréée et mise en place par celle-ci »*. Il se félicite par ailleurs de *« l'expertise de l'OMS, particulièrement en ce qui concerne l'information qu'elle produit et qui repose sur une science d'excellente facture »*.

La GSM Association (GSMA), l'autre lobby de l'industrie, qui regroupe près de 700 opérateurs dans 213 pays, contribue également au budget constitué par M. Repacholi et, aujourd'hui, par Mme van Deventer. *« La GSMA fournit 50.000 € par an depuis la fin des années 1990, précise son porte-parole David Pringle. Cette somme s'est élevée à 150.000 € en 2005 et 2006. Nous revoyons le montant chaque année, mais nous prévoyons de continuer à soutenir cet important travail au même niveau de financement dans le futur. »* Pringle précise en outre que la GSMA *« ne joue aucun rôle au sein du Comité consultatif indépendant qui fait le point sur les activités du projet CEM de l'OMS »*.

D'autres groupes d'intérêts financent également le projet CEM. Ainsi, la FGF, une association « indépendante » largement financée par l'industrie de la téléphonie mobile allemande, subventionne le projet à concurrence de 15.000 € par an. Au total, il s'avère que l'industrie du mobile a financé, à elle seule, plus de 40% du budget du projet CEM de l'année fiscale 2005-2006 - lequel s'élevait à 725.000 $. Cette proportion de financement industriel ne tient évidemment pas compte du possible soutien financier de l'industrie électrique.

« Si ce n'est pas une violation des règles de l'OMS, c'est certainement une violation de l'esprit des règles », s'indigne Louis Slesin, qui s'interroge comme beaucoup de monde sur l'indépendance réelle de M. Repacholi durant son mandat à la tête du projet CEM. Slesin souligne d'ailleurs que les seuils d'exposition prônés par l'OMS ne sont pas suivis par plusieurs pays. *« Mike veut nous faire croire qu'il est la voix de la raison, mais en réalité ce sont ses positions qui sont déphasées par rapport à celles de nombreux gouvernements nationaux. La Chine, l'Italie, la Suisse, la Russie et le Luxembourg ont tous adopté des limites d'exposition préventives - rejetant directement les appels de Mike pour harmoniser les standards de rayonnement. De plus, des commissions d'experts en Angleterre, France, Allemagne, Belgique, Irlande, Suède, Autriche, Russie et Taiwan ont toutes émis des avis décourageant les enfants d'utiliser des téléphones mobiles. »*

Un retraité très actif

Depuis sa retraite française d'Aix-les-Bains, au bord du Lac du Bourget, Mike Repacholi se contente de discréditer son principal détracteur. *« Je ne me préoccupe pas des commentaires de Slesin car il ne me contacte jamais pour valider ses informations, nous écrit-il. Ses articles n'ont donc aucune crédibilité. Il a publié tellement d'informations erronées. Assurément, les scientifiques dont l'opinion m'importe n'accordent aucune foi à ses écrits. Il a eu l'occasion de se montrer utile dans le domaine des champs électromagnétiques mais a échoué lamentablement. »*

Présidente du Centre de recherche et d'information indépendantes sur les rayonnements électromagnétiques (CRIIREM) et cosignatrice de la lettre ouverte à la direction générale de l'OMS, Michèle Rivasi estime au contraire que Louis Slesin est un « lanceur d'alerte » susceptible de secouer le cocotier genevois. *« J'espère vraiment qu'Emilie van Deventer, qui remplace Repacholi, témoignera de plus de vigilance dans le choix des experts et qu'elle associera à l'avenir la société civile dans la prise de décision. Ayant effectué de nombreuses mesures dans des habitations exposées aux antennes relais, je suis convaincue - et je suis loin d'être la seule - que nous sommes à l'aube d'importants problèmes de santé publique. »*

Depuis sa mise à la retraite, M. Repacholi n'est pas resté inactif. Bien au contraire. Renouant avec un vieil atavisme, il ne s'est pas privé de « consulter » pour l'industrie électrique étasunienne. Le 26 octobre 2006, soit moins de quatre mois après son départ de l'OMS, l'homme témoignait pour le compte de la Connecticut Light and Power Co. et de la United Illuminating Co. afin d'influencer le Conseil chargé du choix des implantations des lignes à haute tension dans l'Etat du Connecticut. Cette instance publique est actuellement en train d'harmoniser les normes d'exposition de la population aux champs électromagnétiques émis par les lignes à haute tension.

L'exposé de M. Repacholi visait à montrer que les normes en vigueur sont trop strictes et qu'il serait scientifiquement fondé de les assouplir, minimisant au passage les nombreux résultats d'études montrant que le risque de leucémie infantile est accru à proximité des lignes à haute tension. Pour appuyer son audition, M. Repacholi n'a pas hésité à exploiter de façon douteuse des documents de travail de l'OMS non encore finalisés. En effet, pas moins de six coauteurs de ces textes lui ont reproché d'avoir déformé certaines conclusions ou d'en avoir présenté des extraits de façon partiale et trompeuse.

Nul ne sait combien d'argent M. Repacholi a touché pour réaliser son rapport d'expertise de 56 pages. Deux autres consultants ayant récemment travaillé pour les deux mêmes compagnies électriques ont tous deux été

rémunérés au tarif de 400 $/heure.

Un rapport de l'OMS « appauvri »

Quelques jours après cette « pige » pour l'industrie électrique, l'ex-haut fonctionnaire de l'OMS se retrouvait au centre d'une polémique médiatique. En Angleterre, cette fois, dans une enquête sur les armes à uranium appauvri (UA) réalisée par Angus Stickler, journaliste à la BBC. Sur les ondes de Radio Four, le Dr. Keith Baverstock, professeur en sciences de l'environnement de l'université de Kuopio (Finlande) et ex-directeur du service de radioprotection du Bureau européen de l'OMS, accusait son ancien supérieur hiérarchique, Mike Repacholi, d'avoir minimisé les dangers de l'UA pour les populations vivant à proximité de sites bombardés.

Des projectiles conventionnels contenant de l'UA ont été utilisés en 1991 pendant la guerre du Golfe, en 2003 contre l'Irak, mais aussi en Bosnie, en Serbie, au Kosovo et, selon des sources non-officielles, en Afghanistan. Très dur et très dense, l'UA est principalement utilisé dans les armes anti-char. Quand un obus explose, il génère un nuage de poussières contenant des oxydes d'uranium. Inhalées ou ingérées, ces particules toxiques et radioactives peuvent, à long terme, causer des cancers et des malformations chez les nouveaux-nés. Dans le monde, plusieurs initiatives visent aujourd'hui à interdire ces armes. En Belgique, une récente proposition de loi allant dans ce sens a été déposée par le député socialiste Dirk Van der Maelen.

Un rapport de synthèse de l'OMS, coordonné par M. Repacholi et publié en 2001, a notamment conclu que «[dans les zones de conflit où l'uranium appauvri a été utilisé, il n'est pas nécessaire de soumettre les populations à un dépistage ou à un contrôle généralisé des effets éventuels sur leur santé »]i. Pour M. Repacholi, il faut que *« l'exposition soit importante pour observer des effets sur la santé »*. A ses yeux, *« l'uranium apauvri est fondamentalement sain »*. Il faudrait en ingérer « une grande quantité » pour observer des effets sanitaires négatifs. Or Baverstock lui reproche précisément d'avoir écarté, lors de la réalisation de ce rapport, pas moins de huit études faisant état d'effets génotoxiques de l'UA, sans qu'une exposition importante soit nécessaire.

« Quand on inhale la poussière, plus elle va se nicher profondémment dans les poumons, plus il est difficile de s'en débarrasser, explique Baverstock. Les particules qui se dissolvent présentent un risque - dû à la radioactivité et à la chimiotoxicité - pour le poumon même et, par la suite, lorsque ce matériaux se diffuse dans le reste du corps et dans le sang, on observe un risque potentiel de leucémie dans des zones comme la moëlle osseuse, le système lymphatique et le foie. » Ces huit études ont pourtant toutes été publiées dans des revues à comité de lecture et auraient logiquement dû être prises en compte dans la synthèse, estime Baverstock. Les jugeant *« spéculatives »*, M. Repacholi a décidé de les écarter.

Un « testament scientifique » sans surprise

Enfin, toujours en novembre dernier, un article scientifique cosigné par Mike Repacholi, Emilie van Deventer et un certain Peter A. Valberg, est paru dans la revue étasunienne Environment Health Perspectives. Portant sur les effets sanitaires possibles des rayonnements électromagnétiques de la téléphonie mobile, l'article concluait - sans surprise - que *« l'exposition du public aux niveaux de radiofréquence autorisés pour la téléphonie mobile et les antennes relais n'est pas susceptible d'affecter la santé humaine de façon négative »*.

Pour Louis Slesin, une chose est claire : les auteurs ont été sélectifs dans le choix des résultats d'étude présentés. *« Par exemple, dans une revue des résultats de l'étude Interphone en cours concernant les risques possibles de cancer associés à l'utilisation des téléphones portables, ils omettent de mentionner ce qui est peut-être le résultat le plus inquiétant à ce jour : un risque statistiquement significatif de neurinome acoustique chez les personnes ayant utilisé des téléphones portables pendant plus de dix ans. La question ouverte des risques possibles à long terme est tout simplement ignorée. »*

L'auteur principal de cet article, Peter A. Valberg, est un expert de l'évaluation des risques pour la santé humaine. Après vingt années de carrière académique à l'Ecole de santé publique de Harvard, M. Valberg s'est reconverti dans le privé. Il travaille actuellement pour Gradient, une société de consultance en environnement. Sur son site Internet, Gradient explique que ses clients font appel à elle *« pour les éclairer sur les questions environnementales qui affectent directement leurs objectifs en affaires et leurs résultats financiers. (...) Nous sommes sollicités pour le sérieux de nos analyses techniques et notre capacité à produire des déclarations claires et à mener des négociations persuasives pour aider nos clients à atteindre leurs objectifs et respecter les lois et les réglementations environnementales. »*

Pas étonnant, dès lors, que M. Valberg soit un consultant régulier pour l'industrie électrique étasunienne - ce que son curriculum vitæ se garde pourtant bien de préciser. Afin d'obtenir les permis nécessaires auprès des autorités publiques, de nombreuses compagnies ont fait appel à ses services pour minimiser au maximum les risques sanitaires liés à l'installation de nouvelles lignes à haute tension. M. Valberg a ainsi témoigné pour la Appalachian Power Company (Virginie Occidentale) en 1998, pour Xcel Energy (Minnesota) en 2001, pour la Commonwealth Electric Co. (Massachusetts) en 2003, pour la Vermont Electric Power Co. (Vermont) en 2004, pour la Boston Edison Co. (Massachusetts) en 2005, et pour ITC Transmission (Michigan) en 2006.

Les compétences de M. Valberg ne se limitent cependant pas au domaine des champs électromagnétiques émis par les lignes à haute tension. En 1997, lorsque le Bureau d'évaluation des risques sanitaires environnementaux de Californie a souhaité classer les particules fines émises par les moteurs diesels dans la catégorie des polluants toxiques, M. Valberg a témoigné en faveur de la Engine Manufacturers Association, le lobby des motoristes étasuniens, pour minimiser les risques sanitaires liés à l'inhalation de ces particules. Et à l'automne dernier, M. Valberg est intervenu en faveur des cigarettiers étasuniens dans le cadre d'un procès qui les oppose à un groupe de fumeurs de cigarettes light estimant avoir été dupés par des publicités qui présentaient ces cigarettes comme plus saines que les autres.

On connaît les campagnes antitabac de l'OMS et son combat contre leur sabotage par les cigarettiers. Le Centre international de recherche sur le cancer, une agence de l'OMS, considère depuis 2001 que les rayonnements électromagnétiques émis par les lignes à haute tension sont *« peut-être cancérogènes pour l'homme »*. L'OMS a également tiré la sonnette d'alarme à propos des particules fines en rappelant avec force qu'elles constituent un grave problème de santé publique. Qu'un ex-haut fonctionnaire de l'OMS, institution publique internationale censée défendre l'intérêt sanitaire général, cosigne son « testament scientifique » avec un consultant pour l'industrie ayant à de nombreuses reprises défendu des intérêts radicalement opposés aux missions mêmes de l'OMS, n'a visiblement ému personne. Mais qui s'est jamais soucié de M. Repacholi, de son parcours professionnel et de ses conditions de travail ?

David Leloup
article publié sur AgoraVox le 26/01/2007

Source : http://www.agoravox.fr/article.php3?id_article=18299

NB : Lire en pièce jointe (OMS_2007.pdf) le 'discrédit public de l'OMS'

Robin des Toits

Source :
http://www.robindestoits.org

Annexe 9

Interdisziplinäre Gesellschaft für Umweltmedizin e. V.

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9. Oktober 2002

APPEL DE FRIBOURG

Par grand souci pour la santé de nos contemporains nous nous adressons - en tant que médecins de toutes spécialités (spécialement de la médecine environnementale),

ayant un cabinet - au corps médical, aux responsables de l'hygiène et santé publiques et au public.

Nous constatons ces années passées chez nos patients une augmentation dramatique de maladies graves et chroniques, en particulier des

- troubles de l'apprentissage, de la concentration et du comportement chez les enfants (hyperactivité par exemple)
- troubles de tension artérielle
- troubles cardiaques
- infarctus et accidents vasculaires cérébraux (aka AVC, apoplexie)
- maladies à dégénérance neurologique (par exemple morbus Alzheimer) et épilepsie
- maladies cancéreuses comme la leucémie et des tumeurs cérébrales

Nous constatons en plus la présence de différentes troubles, qui sont souvent mal interprétées comme psychosomatiques, telles que

- maux de tête et migraine
- épuisement chronique
- inquiétude intérieure
- insomnie et asthénie
- bruit dans les oreilles
- prédisposition aux infections
- douleurs dans les nerfs et les parties molles qu'on ne peut pas expliquer par des raisons normales

pour mentionner seulement les symptômes les plus frappants.

Comme nous connaissons l'environnement résidentiel et les habitudes de nos patients, nous voyons – après une interrogation à but précis – toujours plus souvent une claire

relation temporelle et spatiale entre l'émergence de ces maladies et le début d'une richesse en ondes radio, par exemple sous forme

- de l'installation d'une disposition de téléphone cellulaire mobile dans les environs de nos patients
- d'une utilisation intensive de portables
- de l'achat d'un téléphone sans fil standard DECT dans la propre maison ou dans le voisinage.

Nous n'arrivons plus à croire à une coïncidence seulement par hasard, car

- trop souvent nous constatons une accumulation frappante de certaines maladies dans des quartiers ou immeubles,
- trop souvent la maladie s'améliore ou des maux qui ont duré des mois ou des années disparaissent en relativement peu de temps après la réduction ou élimination de la richesse en ondes radio dans les environs d'un patient
- trop souvent des mesures de la biologie de la construction par rapport à des intensités d'ondes radio électromagnétiques extraordinaires sur place confirment en plus nos observations.

En raison de nos expériences quotidiennes nous considérons la technologie du téléphone cellulaire mobile, introduite en 1992 et entre temps omniprésent, et les téléphones sans fil depuis 1995 avec le standard DECT comme un des déclencheurs importants de cette évolution fatale! Personne ne peut échapper totalement à ces hyperfréquences. Elles renforcent le risque d'influences de l'environnement chimiques et physiques déjà existantes, chargent en outre les défenses immunitaires et sont capables de faire succomber les mécanismes de contre-régulation qui créent encore un équilibre. Ce danger existe spécialement pour des enceintes, enfants, adolescents et des personnes âgées et malades.
Nos efforts thérapeutiques pour le rétablissement de la santé restent toujours plus sans succès. Car la pénétration, sans obstacles, du rayonnement permanent dans les appartements et les lieux de travail, spécialement dans les chambres des enfants et les salles de séjour (que nous considérons comme des lieux importants pour la détente, la régénération et la guérison) causent du stress sans arrêt et empêchent le rétablissement fondamental du malade.

En vue de cette évolution inquiétante nous nous sentons obligés d'informer le public de nos observations, spécialement ayant entendu que des tribunaux allemands regardent le danger par le téléphone cellulaire mobile simplement comme „uniquement hypothétique“ (voir des jugements du tribunal constitutionnel fédéral allemand [Bundesverfassungsgerichts] à Karlsruhe et du tribunal administratif d'appel à Mannheim [Verwaltungsgerichtshof] du printemps 2002).

Ce que nous vivons dans le quotidien de notre cabinet est loin d'être hypothétique. Nous voyons un nombre croissant de malades chroniques, aussi comme conséquence d'une politique irresponsable de valeurs limites, qui – au lieu de prendre la protection

de la population envers les conséquences du rayonnement du **téléphone cellulaire mobile** à court et surtout à long terme comme mesure pour ses actes –
se soumet à l'injonction d'une technologie qui est reconnue assez longtemps déjà comme dangereuse. Pour nous c'est le début d'une évolution qu'on doit prendre très au sérieux, par laquelle la santé de beaucoup de personnes est menacée.
Nous ne nous laissons pas renvoyer à d'autres résultats de recherche irréels, qui sont – comme le montre souvent l'expérience – influencés par l'industrie, tandis que des expertises probantes sont ignorées ! Agir revêt une nécessité absolue pour nous !
En tant que médecins nous sommes avant tout les avocats de nos patients. Dans l'intérêt de toutes les personnes concernées, dont le droit fondamental de vie et de l'intégrité du corps sont mis en jeu actuellement, nous en appelons aux responsables dans la politique et la société. Soutenez avec toute votre influence nos revendications:

- de nouvelles techniques de communication conformes à la santé humaine, ayant égard aux risques, surtout avant l'introduction, sans dépendre de n'importe quel bailleur de fonds privé

et comme mesures immédiates et dispositions transitoires

- réduction massive des valeurs limites, des puissances d'émission et des charges en ondes radio à une mesure responsable par rapport à la biologie, surtout dans les zones de sommeil et de régénération
- aucune extension de la technologie du téléphone cellulaire mobile afin que l'exposition aux rayonnements ne se multiplie pas
- le droit d'intervention de la population et des communes lors de la planification des endroits des antennes, ce qui devrait aller de soi dans une démocratie
- éclaircir la population - et surtout les utilisateurs de portables – des risques de santé causés par des champs électromagnétiques et ainsi une fréquentation plus consciente; interdiction de portables pour les enfants et restriction d'emploi pour les jeunes
- interdiction d'utilisation de portables et de téléphones sans fil de standard DECT dans les écoles maternelles, écoles, hôpitaux, maisons de retraite, lieux de rencontre, bâtiments publics et transports en commun analogue à la défense de fumer
- des zones sans portables et téléphone cellulaire mobile analogue à des zones sans automobiles
- révision du standard DECT pour les téléphones sans fil avec le but de réduire l'intensité des rayonnements et de limiter le rayonnement à la durée de l'emploi réel ainsi que d'éviter la pulsation biologiquement critique
- la recherche scientifique indépendante de l'industrie ayant enfin égard aux multiples résultats de la recherche critique et nos observations médicales

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