



Beatrice Alexandra Golomb, MD, PhD
Professor of Medicine
UC San Diego School of Medicine
9500 Gilman Drive, #0995
La Jolla, CA 92093-0995
Phone: 858 558-4950 x201

August 18, 2017

To whom it may concern,

I urge in the strongest terms that you vigorously oppose California SB 649.

If this bill passes, many people will suffer greatly, and needlessly, as a direct result.

This sounds like hyperbole. It is not.

My research group at UC San Diego alone has received hundreds of communications from people who have developed serious health problems from electromagnetic radiation, following introduction of new technologies. Others with whom I am in communication, have independently received hundreds of similar reports. Most likely these are a tip of an iceberg of tens or perhaps hundreds of thousands of affected person. As each new technology leading to further exposure to electromagnetic radiation is introduced – and particularly introduced in a fashion that prevents vulnerable individuals from avoiding it – a new group become sensitized to health effects. This is particularly true for pulsed signals in the radiowave and microwave portion of the spectrum, the type for which the proposed bill SB 640 will bypass local control.

Mechanisms by which health effects are exerted have been shown to include oxidative stress (the type of injury against which antioxidants protect, see optional section below), damage to mitochondria (the energy producing parts of cells), damage to cell membranes^{1,21}, and via these mechanisms, an impaired “blood brain barrier”³⁻⁵ (the blood brain barrier defends the brain against introduction of foreign substances and toxins; additionally, disruption can lead to brain edema⁶), constriction of blood vessels and impaired blood flow to the brain⁷, and triggering of autoimmune reactions^{8,9}. Following a large exposure, that depresses antioxidant defenses, magnifying vulnerability to future exposures, some persons no longer tolerate many other forms and intensities of electromagnetic radiation that previously caused them no problem, and that currently cause others no problem. But this group deserves – nay needs -- the right to be able to avoid these exposures.

Affected individuals not only experience “symptoms” that “merely” cause them distress and suffering, when they are exposed – symptoms like headaches^{10,11}, ringing ears^{10,11} and chest pain¹⁰ from impaired blood flow, heart rhythm abnormalities^{10,11}, and inability to sleep^{10,11}. These symptoms arise from physiological injury. Moreover, **many experience significant health problems that can include seizures¹¹, heart failure, hearing loss¹²⁻¹⁴ and severe cognitive impairment^{11,15}**. The mechanisms involved are those also involved in development and progression of neurodegenerative conditions including Alzheimer’s disease¹⁶.



Fully half who were employed when their problems developed lost their job because of the problem, among participants of a survey we conducted. They reported that their condition had cost them up to 2 million dollars to date. Many had lost their homes. A number became homeless, and have swelled the ranks of so-called “EMF refugees”¹⁷⁻¹⁹. Among those affected, many were previously high functioning individuals – engineers, doctors, lawyers. The best and the brightest are among those whose lives – and ability to contribute to society – will be destroyed. High profile individuals with acknowledged electrohypersensitivity include, for instance, Gro Harlem Brundtland – the former 3-time Prime Minister of Norway and former Director General of the World Health Organization²⁰; Matti Niemela, former Nokia Technology chief²¹; as well as the wife of Frank Clegg²², who formerly headed Microsoft Canada and is current head of Canadians for Safe Technology²³.

Each new roll-out of electromagnetic technology for which exposure is obligatory, swells the ranks of those who develop problems with electromagnetic fields (EMF).- particularly following a significant exposure to pulsed radiowave-microwave radiation, and particularly when people have no ability to avoid it.

Many state that they didn’t give credence to the problem (if they had heard of it at all) **until they themselves fell prey to it.**

This is not a psychologically driven condition. Multiple objective physiological changes reflecting mechanisms of injury have been shown in persons with this condition^{24, 25}.

The role for oxidative stress, that has been shown in innumerable studies (below), **is affirmed by evidence of a link of this condition to genetic variants in antioxidant defenses,** that are less avid in defending against oxidative stress³⁰⁷. People cannot manipulate their genes, to produce such an outcome by suggestibility.

An analysis by a University of Washington researcher showed that most studies funded by industry reported failure to show physiological effects. However, most studies without such industry bias affirmed effects. This is redolent of findings shown in medicine²⁶, regarding which the former editor in chief of the BMJ (the British Medical Journal), Richard Smith, noted, based on findings of a study, “This {result} suggests that, far from conflict of interest being unimportant in the objective and pure world of science where method and the quality of data is everything, it is the main factor determining the result of studies.”²⁷. So where articles deny injury from nonionizing radiowave-microwave radiation, there is commonly a stake aligned with financial benefit from such denial.

Those who are affected are in desperate need of protection by our elected officials. They need creation of safe spaces and housing, and roadways to allow travel, not removal of any prospect of one; protection of local rights to make decisions - **not removal of any recourse or ability to avoid what injures them.** They are far more strongly in need of protections than a great many protected classes – their problems arose due to actions of others, against which they were given no control – *and can be reversed*, in most cases, if the assault on them is rolled back. Through no fault of their own, and in some cases against their will (e.g. before opt out was permitted with smart meters), they were subjected to an



exposure that has altered their lives as they knew them, and forced them – needlessly - to the margins of society.

Let our focus be on safer, wired and well shielded technology – not more wireless.

This legislation, if passed, and the resulting unrestricted roll-out of this technology, will predictably and directly injure and disable a new group, and add depth of suffering to those already affected.

In other spheres we abridge freedoms to protect the vulnerable few. We require that every schoolchild be vaccinated, supposedly to protect the vulnerable few who may not respond effectively to a vaccine. The need to protect the vulnerable group is deemed to be so great that it justifies the decision to abridge individual rights.

In contrast, this bill seeks to abridge individual freedoms, and local rights, in the service of *harming* a vulnerable group, and creating a new one.

(The common factor appears to be that in both cases, the direction is aligned with a powerful industry that influences political decisions.)

Luckily, no abridgment of individual rights and freedoms is required to protect, here.

If any group can opt out (such as, I understand, firefighters*)²⁸; **then every group deserves that equal right.** Others should not be second class citizens, subject to fewer protections.

It would go far to helping this cause if anyone complicit in promoting or passing the legislation (and then after that, *their* families) were required to be the first subjected, for a substantial test period, to the *greatest* amount of exposure that anyone *else* (and their families) may be subjected to, when new policies of this type are rolled out. It will still not do them equal damage; because they may not represent the vulnerabilities that others will have; but such a policy might help them to think twice. *That* is a bill I would strongly endorse.

Most who are now affected – were not, until they were. This may become you – or your child or grandchild. Moreover, if you have a child, or a grandchild, his sperm, or her eggs (all of which she will already have by the time she is a fetus in utero), will be affected by the oxidative stress damage created by the electromagnetic radiation, in a fashion that may affect your future generations irreparably.

It was noted above that, among survey completers, fully half of those who were employed at the time they developed electrosensitivity, lost employment *due to* this problem. (This may understate the scope of the tragedy, since this most-affected group may be least likely to be able to respond to an online survey.) **Many who previously had no problem navigating in the world are now restricted from access to basic services** like hospital care, post offices and libraries because of these problems. With each new introduction of technology that exposes many to yet a new nondiscretionary source of electromagnetic radiation, particularly (but not exclusively) that which emits pulsed radiation in the radiowave-microwave part of the spectrum, a new group of people are affected; and the suffering of those who are already affected increases greatly.



Please, defend the public and our future. Protect the rights of the individual and the locality, against a form of incursion that will lead to serious harm to some – and set a terrible precedent. **Vote no on California SB 649**, and urge that everyone else do the same.

Sincerely,

Beatrice Alexandra Golomb, MD, PhD
 Professor of Medicine
 UC San Diego School of Medicine

*Comment on the fire fighter exemption: “The legislature granted an exemption from SB 649 to the firefighters who requested it for health reasons. Throughout California firefighters have long complained of often disabling symptoms from cell towers on their stations. Cities frequently rent out space on fire stations to add to city revenue. ...Symptoms experienced by the firefighters have included neurological impairment including severe headache, confusion, inability to focus, lethargy, inability to sleep, and inability to wake up for 911 emergency calls. Firefighters have reported getting lost on 911 calls in the same community they grew up in, and one veteran medic forgot where he was in the midst of basic CPR on a cardiac victim and couldn’t recall how to start the procedure over again...Prior to the installation of the tower on his station, this medic had not made a single mistake in 20 years. A pilot study (2004) of California firefighters showed brain abnormalities, cognitive impairment, delayed reaction time, and lack of impulse control in all 6 firefighters tested (<https://ecfsapi.fcc.gov/file/7022117660.pdf>). This study led to the overwhelming passage of Resolution 15 by the International Association of Firefighters in Boston in August 2004. Res. 15 called for further study and was amended to impose a moratorium on the placement of cell towers on fire stations throughout the US and Canada.”^{15 28}
 Clearly, others who experience similar problems also deserve protections.

Optional – More on the Science

There is a robust literature showing that electromagnetic radiation, including in nonionizing frequencies, and at levels^{29,30} below those that are cause thermal effects (heating) – causes physiological effects, injury, and cell death –not only in humans but many animals and plants^{3,7,31-49}. Unsurprisingly, industry has sought – against the tide of evidence to the contrary - to maintain that radiation must be ionizing or heating to cause injury.

Scores or hundreds of studies show that radiation, including specifically radiowave-microwave spectrum radiation, and including low-level exposure, can impair antioxidant defenses, increase “oxidative stress” (free radical injury) and damage mitochondria, the energy producing parts of cells^{1,2,34,50-6930,70-104105-13646,137-171}. These effects occur with ionizing and nonionizing radiation, at thermal and subthermal levels. (Indeed, much or most of the damage by ionizing radiation, and radiation above the thermal limit, occurs by mechanisms also documented to occur without ionization, and below the thermal limit.) These



mechanisms cohere with the mechanisms documented to play a role in symptoms and health conditions that are reported in those who are electrosensitive – extending to seizures¹⁷²⁻¹⁷⁶, heart failure¹⁷⁷⁻¹⁸⁴ and cognitive decline^{5, 32, 57, 108, 185-195}.

These mechanisms have known involvement in induction of brain cancer, metabolic diseases like obesity and diabetes, autism, autoimmune disease, and neurodegenerative conditions, conditions that have exploded. In each case these have been linked, or presumptively linked, in some studies to electromagnetic radiation^{8, 9, 16, 34, 196-219}.

Such radiation also has effects on sperm^{33, 100, 220-228}; and the DNA of sperm²²⁹ (consistent with recent news reports of marked recent declines in sperm counts and function)..

Such radiation also has toxic effects in pregnancy²³⁰, to the fetus and subsequent offspring²³¹⁻²³⁵ including at low levels²³⁶, and is tied to developmental problems in later life, including attention deficit and hyperactivity^{31, 235-241}. It is critical to defend pregnant women (and eggs of girls who may at a later time become pregnant) from exposures with such toxicity.

Electromagnetic radiation across much or most of the spectrum (not excluding visible light) has been shown to depress levels of melatonin^{40, 72, 242-252}, which is best known for its role in sleep (and indeed, impaired sleep is the most consistent symptom in affected individuals^{10, 11}).

Melatonin is in fact a critical antioxidant that defends the body against harm from many toxic exposures²⁵³⁻²⁶⁶ including electromagnetic radiation itself^{61, 66, 67, 82, 101, 107, 118, 121, 138, 144, 151, 204, 249, 267-284} - **reducing the oxidative stress** that is implicated in cancer, metabolic diseases like obesity and diabetes, autism, autoimmune disease, bipolar disorder and neurodegenerative conditions, and that also plays a role in heart attack and stroke^{9, 285-329330-343}.

Radiation, and specifically radiation in the radiowave-microwave portion of the spectrum can also depress levels of other critical antioxidant systems that also defend the body against chemical, radiation, and other sources of injury. These other antioxidant systems include the glutathione system, superoxide dismutase and catalase^{81, 102, 115, 116, 233, 344-358} - which are also involved in defending against health problems.

This suggests that depression of antioxidant defenses due to electromagnetic radiation may magnify risk of chemically induced health effects (and depression of antioxidant systems due to some chemicals may amplify risk of harm from electromagnetic radiation). Indeed just such effects have been reported^{359, 360}.



References.

1. Benderitter M, Vincent-Genod L, Pouget JP, Voisin P. The cell membrane as a biosensor of oxidative stress induced by radiation exposure: a multiparameter investigation. *Radiat Res* 2003;159:471-83.
2. Baureus Koch CL, Sommarin M, Persson BR, Salford LG, Eberhardt JL. Interaction between weak low frequency magnetic fields and cell membranes. *Bioelectromagnetics* 2003;24:395-402.
3. Tang J, Zhang Y, Yang L, et al. Exposure to 900 MHz electromagnetic fields activates the mcp-1/ERK pathway and causes blood-brain barrier damage and cognitive impairment in rats. *Brain Res* 2015;1601:92-101.
4. Nittby H, Brun A, Eberhardt J, Malmgren L, Persson BR, Salford LG. Increased blood-brain barrier permeability in mammalian brain 7 days after exposure to the radiation from a GSM-900 mobile phone. *Pathophysiology* 2009;16:103-12.
5. Zhang. Exposure to 900 MHz electromagnetic fields activates the mcp-1/ERK pathway and causes blood-brain barrier damage and cognitive impairment in rats. *Brain Res* 2015;1609:92-101.
6. Adair JC, Baldwin N, Kornfeld M, Rosenberg GA. Radiation-induced blood-brain barrier damage in astrocytoma: relation to elevated gelatinase B and urokinase. *J Neurooncol* 1999;44:283-9.
7. Aalto S, Haarala C, Bruck A, Sipila H, Hamalainen H, Rinne JO. Mobile phone affects cerebral blood flow in humans. *J Cereb Blood Flow Metab* 2006;26:885-90.
8. Ivanov AA, Grigor'ev lu G, Mal'tsev VN, et al. [Autoimmune processes after long-term low-level exposure to electromagnetic fields (the results of an experiment). Part 3. The effect of the long-term non-thermal RF EMF exposure on complement-fixation antibodies against homogenous tissue]. *Radiats Biol Radioecol* 2010;50:17-21.
9. Grigor'ev lu G, Mikhailov VF, Ivanov AA, et al. [Autoimmune processes after long-term low-level exposure to electromagnetic fields (the results of an experiment). Part 4. Manifestation of oxidative intracellular stress-reaction after long-term non-thermal EMF exposure of rats]. *Radiats Biol Radioecol* 2010;50:22-7.
10. Lamech F. Self-reporting of symptom development from exposure to radiofrequency fields of wireless smart meters in victoria, australia: a case series. *Altern Ther Health Med* 2014;20:28-39.
11. Halteman E. Wireless utility meter safety impacts survey: Final Results Summary. Sept 13 2011;(<http://emfsafetynetwork.org/wp-content/uploads/2011/09/Wireless-Utility-Meter-Safety-Impacts-Survey-Results-Final.pdf>). 97.
12. Alsanosi AA, Al-Momani MO, Hagr AA, Almomani FM, Shami IM, Al-Habeeb SF. The acute auditory effects of exposure for 60 minutes to mobile's electromagnetic field. *Saudi Med J* 2013;34:142-6.
13. Karaer I, Simsek G, Gul M, et al. Melatonin protects inner ear against radiation damage in rats. *Laryngoscope* 2015.
14. Celiker H, Ozgur A, Tumkaya L, et al. Effects of exposure to 2100MHz GSM-like radiofrequency electromagnetic field on auditory system of rats. *Braz Otorhinolaryngol* 2016;S1808-8694:302221.
15. Foster S. Health exemption for firefighters sends a message to the world. *GALLERY*;Posted on June 26, 2017.
16. Sobel E, Davanipour Z, Sulkava R, et al. Occupations with exposure to EMFs: a possible link for Alzheimer's disease. *Amer J Epidemiol* 1995;142:515-24.



17. Stein Y. Environmental refugees. UNESCO 10th World Conference on ZBioethics, Medical Ethics and Health Law 2015;Jerusalem, Israel:Jan 6-8.
18. Frompovich CJ. Environmental refugees: Electromagnetic hypersensitivity (EHS) sufferers. Naturalblazecom 2016;Jan 28.
19. <http://www.emfanalysis.com/emf-refugee/>.
20. [;http://articles.latimes.com/2010/feb/15/health/la-he-electromagnetic-syndrome1-2010feb15](http://articles.latimes.com/2010/feb/15/health/la-he-electromagnetic-syndrome1-2010feb15).
21. <http://stopsmartmetersorguk/former-nokia-chief-mobile-phones-wrecked-my-health/>.
22. [;http://www.huffingtonpost.ca/frank-clegg/post_5393_b_3745157.html](http://www.huffingtonpost.ca/frank-clegg/post_5393_b_3745157.html).
23. Clegg F. Electrohypersensitivity Is Real. The Huffington Post, Canada 2013;June 12, 2013.
24. Belpomme D, Campagnac C, Irigaray P. Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. Rev Environ Health 2015;30:251-71.
25. Heuser G, Heuser SA. Functional brain MRI in patients complaining of electrohypersensitivity after long term exposure to electromagnetic fields. . Rev Environ Health 2017;Jul 5.
26. Golomb BA. Conflict of Interest in Medicine
<http://thesciencenetwork.org/programs/beyond-belief-candles-in-the-dark/beatrice-golomb>: Beyond Belief: Candles in the Dark, sponsored by The Science Network (tsntv.org), session entitled "This is Your Brain on Politics" Salk Institute. La Jolla, CA. Oct 5; 2008.
27. Smith R. Conflicts of interest: how money clouds objectivity. J R Soc Med 2006;99:292-7.
28. International Association of Fire Fighters Division of Occupational Health SaM. Position on the health effects from radio frequency/ microwave (RF/MW) radiation in fire department facilities from base stations for antennas and towers for the conduction of cell phone transmissions. 2006.
29. Gurler HS, Bilgici B, Akar AK, Tomak L, Bedir A. Increased DNA oxidation (8-OHdG) and protein oxidation (AOPP) by low level electromagnetic field (2.45 GHz) in rat brain and protective effect of garlic. Int J Radiat Biol 2014;90:892-6.
30. Jajte J, Zmyslony M. [The role of melatonin in the molecular mechanism of weak, static and extremely low frequency (50 Hz) magnetic fields (ELF)]. Med Pr 2000;51:51-7.
31. Hardell L, Sage C. Biological effects from electromagnetic field exposure and public exposure standards. Biomed Pharmacother 2008;62:104-9.
32. Deshmukh PS, Nasare N, Megha K, et al. Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation. Int J Toxicol 2015;34:284-90.
33. Avendano C, Mata A, Sanchez Sarmiento CA, Doncel GF. Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation. Fertil Steril 2012;97:39-45 e2.
34. Barnes F, Greenenbaum B. Some Effects of Weak Magnetic Fields on Biological Systems: RF fields can change radical concentrations and cancer cell growth rates. IEEE Power Electronics Magazine 2016;3:60-8.
35. Blank M, Goodman R. Comment: a biological guide for electromagnetic safety: the stress response. Bioelectromagnetics 2004;25:642-6; discussion 7-8.



36. Burlaka A, Selyuk M, Gafurov M, Lukin S, Potaskalova V, Sidorik E. Changes in mitochondrial functioning with electromagnetic radiation of ultra high frequency as revealed by electron paramagnetic resonance methodsX. *Int J Radiat Biol* 2014;90:357-62.
37. Derias EM, Stefanis P, Drakeley A, Gazvani R, Lewis-Jones DI. Growing concern over the safety of using mobile phones and male fertility {THERMAL + NONTHERMAL}. *Arch Androl* 2006;52:9-14.
38. Diem E, Schwarz C, Adlkofer F, Jahn O, Rudiger H. Non-thermal DNA breakage by mobile-phone radiation (1800 MHz) in human fibroblasts and in transformed GFSH-R17 rat granulosa cells in vitro. *Mutat Res* 2005;583:178-83.
39. Ferreira AR, Knakievicz T, Pasquali MA, et al. Ultra high frequency-electromagnetic field irradiation during pregnancy leads to an increase in erythrocytes micronuclei incidence in rat offspring. *Life Sci* 2006;80:43-50.
40. Halgamuge MN. Pineal melatonin level disruption in humans due to electromagnetic fields and ICNIRP limits. *Radiat Prot Dosimetry* 2013;154:405-16.
41. Mancinelli F, Caraglia M, Abbruzzese A, d'Ambrosio G, Massa R, Bismuto E. Non-thermal effects of electromagnetic fields at mobile phone frequency on the refolding of an intracellular protein: myoglobin. *J Cell Biochem* 2004;93:188-96.
42. Lai H. Research on the neurological effects of nonionizing radiation at the University of Washington. *Bioelectromagnetics* 1992;13:513-26.
43. Lerchl A, Kruger H, Niehaus M, Streckert JR, Bitz AK, Hansen V. Effects of mobile phone electromagnetic fields at nonthermal SAR values on melatonin and body weight of Djungarian hamsters (*Phodopus sungorus*) - BODY WT CHG. *J Pineal Res* 2008;44:267-72.
44. Leszczynski D, Joenvaara S, Reivinen J, Kuokka R. Non-thermal activation of the hsp27/p38MAPK stress pathway by mobile phone radiation in human endothelial cells: molecular mechanism for cancer- and blood-brain barrier-related effects. *Differentiation* 2002;70:120-9.
45. Lixia S, Yao K, Kaijun W, et al. Effects of 1.8 GHz radiofrequency field on DNA damage and expression of heat shock protein 70 in human lens epithelial cells. *Mutat Res* 2006;602:135-42.
46. Sahin D, Ozgur E, Guler G, et al. The 2100MHz radiofrequency radiation of a 3G-mobile phone and the DNA oxidative damage in brain. *J Chem Neuroanat* 2016;75:94-8.
47. Song JM, Milligan JR, Sutherland BM. Bistranded oxidized purine damage clusters: induced in DNA by long-wavelength ultraviolet (290-400 nm) radiation? *Biochemistry* 2002;41:8683-8.
48. Yurekli AI, Ozkan M, Kalkan T, et al. GSM base station electromagnetic radiation and oxidative stress in rats. *Electromagn Biol Med* 2006;25:177-88.
49. Tafforeau M, Verdus MC, Norris V, et al. Plant sensitivity to low intensity 105 GHz electromagnetic radiation. *Bioelectromagnetics* 2004;25:403-7.
50. Ciejka E, Jakubowska E, Zelechowska P, Huk-Kolega H, Kowalczyk A, Goraca A. [Effect of extremely low frequency magnetic field on glutathione in rat muscles]. *Med Pr* 2014;65:343-9.
51. Consales C, Merla C, Marino C, Benassi B. Electromagnetic fields, oxidative stress, and neurodegeneration. *Int J Cell Biol* 2012;2012:683897.
52. Copeland ES. Production of free radicals in reduced glutathione and penicillamine by thermal hydrogen atoms and X-radiation. *Int J Radiat Biol Relat Stud Phys Chem Med* 1969;16:113-20.



53. Cravotto G, Binello A, Di Carlo S, Orio L, Wu ZL, Ondruschka B. Oxidative degradation of chlorophenol derivatives promoted by microwaves or power ultrasound: a mechanism investigation. *Environ Sci Pollut Res Int* 2010;17:674-87.
54. Crouzier D, Perrin A, Torres G, Dabouis V, Debouzy JC. Pulsed electromagnetic field at 9.71 GHz increase free radical production in yeast (*Saccharomyces cerevisiae*). *Pathol Biol (Paris)* 2009;57:245-51.
55. de Moraes Ramos FM, Schonlau F, Novaes PD, Manzi FR, Boscolo FN, de Almeida SM. Pycnogenol protects against ionizing radiation as shown in the intestinal mucosa of rats exposed to X-rays. *Phytother Res* 2006;20:676-9.
56. Devi PU, Ganasoundari A. Modulation of glutathione and antioxidant enzymes by *Ocimum sanctum* and its role in protection against radiation injury. *Indian J Exp Biol* 1999;37:262-8.
57. Deshmukh PS, Banerjee BD, Abegaonkar MP, et al. Effect of low level microwave radiation exposure on cognitive function and oxidative stress in rats. *Indian J Biochem Biophys* 2013;50:114-9.
58. Dimri M, Joshi J, Chakrabarti R, Sehgal N, Sureshababu A, Kumar IP. Todralazine protects zebrafish from lethal effects of ionizing radiation: role of hematopoietic cell expansion. *Zebrafish* 2015;12:33-47.
59. Dimri M, Joshi J, Shrivastava N, Ghosh S, Chakraborti R, Indracanti PK. Prilocaine hydrochloride protects zebrafish from lethal effects of ionizing radiation: role of hematopoietic cell expansion. *Tokai J Exp Clin Med* 2015;40:8-15.
60. Durovic B, Spasic-Jokic V. Influence of occupational exposure to low-dose ionizing radiation on the plasma activity of superoxide dismutase and glutathione level. *Vojnosanit Pregl* 2008;65:613-8.
61. El-Missiry MA, Fayed TA, El-Sawy MR, El-Sayed AA. Ameliorative effect of melatonin against gamma-irradiation-induced oxidative stress and tissue injury. *Ecotoxicol Environ Saf* 2007;66:278-86.
62. Falone S, Mirabilio A, Carbone MC, et al. Chronic exposure to 50Hz magnetic fields causes a significant weakening of antioxidant defence systems in aged rat brain. *Int J Biochem Cell Biol* 2008;40:2762-70.
63. Fitzgerald MP, Madsen JM, Coleman MC, et al. Transgenic biosynthesis of trypanothione protects *Escherichia coli* from radiation-induced toxicity. *Radiat Res* 2010;174:290-6.
64. Giannopoulou E, Katsoris P, Parthymou A, Kardamakis D, Papadimitriou E. Amifostine protects blood vessels from the effects of ionizing radiation. *Anticancer Res* 2002;22:2821-6.
65. Goraca A, Ciejka E, Piechota A. Effects of extremely low frequency magnetic field on the parameters of oxidative stress in heart. *J Physiol Pharmacol* 2010;61:333-8.
66. Goswami S, Haldar C. UVB irradiation severely induces systemic tissue injury by augmenting oxidative load in a tropical rodent: efficacy of melatonin as an antioxidant. *J Photochem Photobiol B* 2014;141:84-92.
67. Goswami S, Sharma S, Haldar C. The oxidative damages caused by ultraviolet radiation type C (UVC) to a tropical rodent *Funambulus pennanti*: role of melatonin. *J Photochem Photobiol B* 2013;125:19-25.
68. Groen HJ, Meijer C, De Vries EG, Mulder NH. Red blood cell glutathione levels in lung cancer patients treated by radiation and continuously infused carboplatin. *Anticancer Res* 1996;16:1033-7.
69. Guler G, Seyhan N, Aricioglu A. Effects of static and 50 Hz alternating electric fields on superoxide dismutase activity and TBARS levels in guinea pigs. *Gen Physiol Biophys* 2006;25:177-93.
70. Guler G, Turkozer Z, Tomruk A, Seyhan N. The protective effects of N-acetyl-L-cysteine and epigallocatechin-3-gallate on electric field-induced hepatic oxidative stress. *Int J Radiat Biol* 2008;84:669-80.



71. Gultekin FA, Bakkal BH, Guven B, et al. Effects of ozone oxidative preconditioning on radiation-induced organ damage in rats. *J Radiat Res* 2013;54:36-44.
72. Halgamuge MN. Critical time delay of the pineal melatonin rhythm in humans due to weak electromagnetic exposure. *Indian J Biochem Biophys* 2013;50:259-65.
73. Irmak MK, Fadillioglu E, Gulec M, Erdogan H, Yagmurca M, Akyol O. Effects of electromagnetic radiation from a cellular telephone on the oxidant and antioxidant levels in rabbits. *Cell Biochem Funct* 2002;20:279-83.
74. Jagetia G, Baliga M, Venkatesh P. Ginger (*Zingiber officinale* Rosc.), a dietary supplement, protects mice against radiation-induced lethality: mechanism of action. *Cancer Biother Radiopharm* 2004;19:422-35.
75. Jagetia GC, Malagi KJ, Baliga MS, Venkatesh P, Veruva RR. Triphala, an ayurvedic rasayana drug, protects mice against radiation-induced lethality by free-radical scavenging. *J Altern Complement Med* 2004;10:971-8.
76. Jagetia GC, Venkatesha VA, Reddy TK. Naringin, a citrus flavonone, protects against radiation-induced chromosome damage in mouse bone marrow. *Mutagenesis* 2003;18:337-43.
77. Jurkiewicz BA, Bissett DL, Buettner GR. Effect of topically applied tocopherol on ultraviolet radiation-mediated free radical damage in skin. *J Invest Dermatol* 1995;104:484-8.
78. Kalns J, Ryan KL, Mason PA, Bruno JG, Gooden R, Kiel JL. Oxidative stress precedes circulatory failure induced by 35-GHz microwave heating. *Shock* 2000;13:52-9.
79. Karslioglu I, Ertekin MV, Taysi S, et al. Radioprotective effects of melatonin on radiation-induced cataract. *J Radiat Res (Tokyo)* 2005;46:277-82.
80. Kim KC, Piao MJ, Cho SJ, Lee NH, Hyun JW. Phloroglucinol protects human keratinocytes from ultraviolet B radiation by attenuating oxidative stress. *Photodermatol Photoimmunol Photomed* 2012;28:322-31.
81. Klebanoff SJ. The effect of x-radiation on the glutathione metabolism of intact erythrocytes in vitro. *J Gen Physiol* 1958;41:725-36.
82. Koc M, Taysi S, Emin Buyukokuroglu M, Bakan N. The effect of melatonin against oxidative damage during total-body irradiation in rats. *Radiat Res* 2003;160:251-5.
83. Koiram PR, Veerapur VP, Kunwar A, et al. Effect of curcumin and curcumin copper complex (1:1) on radiation-induced changes of anti-oxidant enzymes levels in the livers of Swiss albino mice. *J Radiat Res* 2007;48:241-5.
84. Kowalski S. Changes of antioxidant activity and formation of 5-hydroxymethylfurfural in honey during thermal and microwave processing. *Food Chem* 2013;141:1378-82.
85. Koylu H, Mollaoglu H, Ozguner F, Naziroglu M, Delibas N. Melatonin modulates 900 Mhz microwave-induced lipid peroxidation changes in rat brain. *Toxicol Ind Health* 2006;22:211-6.
86. Koyu A, Ozguner F, Yilmaz H, Uz E, Cesur G, Ozcelik N. The protective effect of caffeic acid phenethyl ester (CAPE) on oxidative stress in rat liver exposed to the 900 MHz electromagnetic field. *Toxicol Ind Health* 2009;25:429-34.
87. Lai H, Singh NP. Melatonin and a spin-trap compound block radiofrequency electromagnetic radiation-induced DNA strand breaks in rat brain cells. *Bioelectromagnetics* 1997;18:446-54.
88. Lai H, Singh NP. Melatonin and N-tert-butyl-alpha-phenylnitron block 60-Hz magnetic field-induced DNA single and double strand breaks in rat brain cells. *J Pineal Res* 1997;22:152-62.



89. Lai H, Singh NP. Magnetic-field-induced DNA strand breaks in brain cells of the rat. *Environ Health Perspect* 2004;112:687-94.
90. Lantow M, Schuderer J, Hartwig C, Simko M. Free radical release and HSP70 expression in two human immune-relevant cell lines after exposure to 1800 MHz radiofrequency radiation. *Radiat Res* 2006;165:88-94.
91. Lee BC, Johng HM, Lim JK, et al. Effects of extremely low frequency magnetic field on the antioxidant defense system in mouse brain: a chemiluminescence study. *J Photochem Photobiol B* 2004;73:43-8.
92. Lee JH, Park JW. The effect of alpha-phenyl-N-t-butyl nitron on ionizing radiation-induced apoptosis in U937 cells. *Free Radic Res* 2005;39:1325-33.
93. Li HT, Schuler C, Leggett RE, Levin RM. Differential effects of coenzyme Q10 and alpha-lipoic acid on two models of in vitro oxidative damage to the rabbit urinary bladder. *Int Urol Nephrol* 2011;43:91-7.
94. Li P, Zhao QL, Wu LH, et al. Isofraxidin, a potent reactive oxygen species (ROS) scavenger, protects human leukemia cells from radiation-induced apoptosis via ROS/mitochondria pathway in p53-independent manner. *Apoptosis* 2014;19:1043-53.
95. Lin SY, Chang HP. Induction of superoxide dismutase and catalase activity in different rat tissues and protection from UVB irradiation after topical application of Ginkgo biloba extracts. *Methods Find Exp Clin Pharmacol* 1997;19:367-71.
96. Lourencini da Silva R, Albano F, Lopes dos Santos LR, Tavares AD, Jr., Felzenszwalb I. The effect of electromagnetic field exposure on the formation of DNA lesions. *Redox Rep* 2000;5:299-301.
97. Low WK, Sun L, Tan MG, Chua AW, Wang DY. L-N-Acetylcysteine protects against radiation-induced apoptosis in a cochlear cell line. *Acta Otolaryngol* 2008;128:440-5.
98. Lulli M, Witort E, Papucci L, et al. Coenzyme Q10 protects retinal cells from apoptosis induced by radiation in vitro and in vivo. *J Radiat Res* 2012;53:695-703.
99. Maaroufi K, Save E, Poucet B, Sakly M, Abdelmelek H, Had-Aissouni L. Oxidative stress and prevention of the adaptive response to chronic iron overload in the brain of young adult rats exposed to a 150 kilohertz electromagnetic field. *Neuroscience* 2011;186:39-47.
100. Mailankot M, Kunnath AP, Jayalekshmi H, Koduru B, Valsalan R. Radio frequency electromagnetic radiation (RF-EMR) from GSM (0.9/1.8GHz) mobile phones induces oxidative stress and reduces sperm motility in rats. *Clinics (Sao Paulo)* 2009;64:561-5.
101. Manda K, Anzai K, Kumari S, Bhatia AL. Melatonin attenuates radiation-induced learning deficit and brain oxidative stress in mice. *Acta Neurobiol Exp (Wars)* 2007;67:63-70.
102. Manda K, Bhatia AL. Pre-administration of beta-carotene protects tissue glutathione and lipid peroxidation status following exposure to gamma radiation. *J Environ Biol* 2003;24:369-72.
103. Manda K, Reiter RJ. Melatonin maintains adult hippocampal neurogenesis and cognitive functions after irradiation. *Prog Neurobiol* 2010;90:60-8.
104. Martinez-Samano J, Torres-Duran PV, Juarez-Oropeza MA, Elias-Vinas D, Verdugo-Diaz L. Effects of acute electromagnetic field exposure and movement restraint on antioxidant system in liver, heart, kidney and plasma of Wistar rats: a preliminary report. *Int J Radiat Biol* 2010;86:1088-94.
105. Mathew ST, Bergstrom P, Hammarsten O. Repeated Nrf2 stimulation using sulforaphane protects fibroblasts from ionizing radiation. *Toxicol Appl Pharmacol* 2014;276:188-94.



106. McArdle AH. Protection from radiation injury by elemental diet: does added glutamine change the effect? *Gut* 1994;35:S60-4.
107. Meena R, Kumari K, Kumar J, Rajamani P, Verma HN, Kesari KK. Therapeutic approaches of melatonin in microwave radiations-induced oxidative stress-mediated toxicity on male fertility pattern of Wistar rats. *Electromagn Biol Med* 2014;33:81-91.
108. Megha K, Deshmukh PS, Banerjee BD, Tripathi AK, Abegaonkar MP. Microwave radiation induced oxidative stress, cognitive impairment and inflammation in brain of Fischer rats. *Indian J Exp Biol* 2012;50:889-96.
109. Mishra S, Reddy DS, Jamwal VS, et al. Semiquinone derivative isolated from *Bacillus* sp. INM-1 protects cellular antioxidant enzymes from gamma-radiation-induced renal toxicity. *Mol Cell Biochem* 2013;379:19-27.
110. Mitchell JB, Russo A. The role of glutathione in radiation and drug induced cytotoxicity. *Br J Cancer Suppl* 1987;8:96-104.
111. Molla M, Gironella M, Salas A, et al. Protective effect of superoxide dismutase in radiation-induced intestinal inflammation. *Int J Radiat Oncol Biol Phys* 2005;61:1159-66.
112. Morabito C, Rovetta F, Bizzarri M, Mazzoleni G, Fano G, Mariggio MA. Modulation of redox status and calcium handling by extremely low frequency electromagnetic fields in C2C12 muscle cells: A real-time, single-cell approach. *Free Radic Biol Med* 2010;48:579-89.
113. Moustafa YM, Moustafa RM, Belacy A, Abou-El-Ela SH, Ali FM. Effects of acute exposure to the radiofrequency fields of cellular phones on plasma lipid peroxide and antioxidant activities in human erythrocytes. *J Pharm Biomed Anal* 2001;26:605-8.
114. Musaev AV, Ismailova LF, Shabanova AB, Magerramov AA, Iusifov E, Gadzhiev AM. [Pro- and antioxidant effect of electromagnetic fields of extremely high frequency (460 MHz) on brain tissues in experiment]. *Vopr Kurortol Fizioter Lech Fiz Kult* 2004:19-23.
115. Mukundan H, Bahadur AK, Kumar A, et al. Glutathione level and its relation to radiation therapy in patients with cancer of uterine cervix. *Indian J Exp Biol* 1999;37:859-64.
116. Navarro J, Obrador E, Pellicer JA, Aseni M, Vina J, Estrela JM. Blood glutathione as an index of radiation-induced oxidative stress in mice and humans. *Free Radic Biol Med* 1997;22:1203-9.
117. Okano H. Effects of static magnetic fields in biology: role of free radicals. *Front Biosci* 2008;13:6106-25.
118. Oktem F, Ozguner F, Mollaoglu H, Koyu A, Uz E. Oxidative damage in the kidney induced by 900-MHz-emitted mobile phone: protection by melatonin. *Arch Med Res* 2005;36:350-5.
119. Oral B, Guney M, Ozguner F, et al. Endometrial apoptosis induced by a 900-MHz mobile phone: preventive effects of vitamins E and C. *Adv Ther* 2006;23:957-73.
120. Ozguner F, Altinbas A, Ozaydin M, et al. Mobile phone-induced myocardial oxidative stress: protection by a novel antioxidant agent caffeic acid phenethyl ester. *Toxicol Ind Health* 2005;21:223-30.
121. Ozguner F, Bardak Y, Comlekci S. Protective effects of melatonin and caffeic acid phenethyl ester against retinal oxidative stress in long-term use of mobile phone: a comparative study. *Mol Cell Biochem* 2006;282:83-8.
122. Ozguner F, Oktem F, Armagan A, et al. Comparative analysis of the protective effects of melatonin and caffeic acid phenethyl ester (CAPE) on mobile phone-induced renal impairment in rat. *Mol Cell Biochem* 2005;276:31-7.



123. Ozguner F, Oktem F, Ayata A, Koyu A, Yilmaz HR. A novel antioxidant agent caffeic acid phenethyl ester prevents long-term mobile phone exposure-induced renal impairment in rat. Prognostic value of malondialdehyde, N-acetyl-beta-D-glucosaminidase and nitric oxide determination. *Mol Cell Biochem* 2005;277:73-80.
124. Ozyurt H, Cevik O, Ozgen Z, et al. Quercetin protects radiation-induced DNA damage and apoptosis in kidney and bladder tissues of rats. *Free Radic Res* 2014;48:1247-55.
125. Pall ML. Scientific evidence contradicts findings and assumptions of Canadian Safety Panel 6: microwaves act through voltage-gated calcium channel activation to induce biological impacts at non-thermal levels, supporting a paradigm shift for microwave/lower frequency electromagnetic field action. *Rev Environ Health* 2015;30:99-116.
126. Patruno A, Tabrez S, Pesce M, Shakil S, Kamal MA, Reale M. Effects of extremely low frequency electromagnetic field (ELF-EMF) on catalase, cytochrome P450 and nitric oxide synthase in erythro-leukemic cells. *Life Sci* 2015;121:117-23.
127. Patwardhan RS, Sharma D, Checker R, Thoh M, Sandur SK. Spatio-temporal changes in glutathione and thioredoxin redox couples during ionizing radiation-induced oxidative stress regulate tumor radio-resistance. *Free Radic Res* 2015;49:1218-32.
128. Paul P, Bansal P, Nayak PG, Pannakal ST, Priyadarsini KI, Unnikrishnan MK. Polyphenolic fraction of *Pilea microphylla* (L.) protects Chinese hamster lung fibroblasts against gamma-radiation-induced cytotoxicity and genotoxicity. *Environ Toxicol Pharmacol* 2012;33:107-19.
129. Pei H, Chen W, Hu W, et al. GANRA-5 protects both cultured cells and mice from various radiation types by functioning as a free radical scavenger. *Free Radic Res* 2014;48:670-8.
130. Piao MJ, Hyun YJ, Oh TH, et al. *Chondracanthus tenellus* (Harvey) hommersand extract protects the human keratinocyte cell line by blocking free radicals and UVB radiation-induced cell damage. *In Vitro Cell Dev Biol Anim* 2012;48:666-74.
131. Pillai S, Oresajo C, Hayward J. Ultraviolet radiation and skin aging: roles of reactive oxygen species, inflammation and protease activation, and strategies for prevention of inflammation-induced matrix degradation - a review. *Int J Cosmet Sci* 2005;27:17-34.
132. Rabbani ZN, Salahuddin FK, Yarmolenko P, et al. Low molecular weight catalytic metalloporphyrin antioxidant AEOL 10150 protects lungs from fractionated radiation. *Free Radic Res* 2007;41:1273-82.
133. Regoli F, Gorbi S, Machella N, et al. Pro-oxidant effects of extremely low frequency electromagnetic fields in the land snail *Helix aspersa*. *Free Radic Biol Med* 2005;39:1620-8.
134. Reliene R, Pollard JM, Sobol Z, Trouiller B, Gatti RA, Schiestl RH. N-acetyl cysteine protects against ionizing radiation-induced DNA damage but not against cell killing in yeast and mammals. *Mutat Res* 2009;665:37-43.
135. Roginskaya M, Bernhard WA, Razskazovskiy Y. Protection of DNA against direct radiation damage by complex formation with positively charged polypeptides. *Radiat Res* 2006;166:9-18.
136. Saenko Y, Cieslar-Pobuda A, Skonieczna M, Rzeszowska-Wolny J. Changes of reactive oxygen and nitrogen species and mitochondrial functioning in human K562 and HL60 cells exposed to ionizing radiation. *Radiat Res* 2013;180:360-6.
137. Sainz RM, Reiter RJ, Tan DX, et al. Critical role of glutathione in melatonin enhancement of tumor necrosis factor and ionizing radiation-induced apoptosis in prostate cancer cells in vitro. *J Pineal Res* 2008;45:258-70.



138. Sener G, Jahovic N, Tosun O, Atasoy BM, Yegen BC. Melatonin ameliorates ionizing radiation-induced oxidative organ damage in rats. *Life Sci* 2003;74:563-72.
139. Sener G, Kabasakal L, Atasoy BM, et al. Ginkgo biloba extract protects against ionizing radiation-induced oxidative organ damage in rats. *Pharmacol Res* 2006;53:241-52.
140. Seyhan N, Guler G. Review of in vivo static and ELF electric fields studies performed at Gazi Biophysics Department. *Electromagn Biol Med* 2006;25:307-23.
141. Shafiee H, Mohammadi H, Rezayat SM, et al. Prevention of malathion-induced depletion of cardiac cells mitochondrial energy and free radical damage by a magnetic magnesium-carrying nanoparticle. *Toxicol Mech Methods* 2010;20:538-43.
142. Sharma R, Tiku AB. Emodin, an anthraquinone derivative, protects against gamma radiation-induced toxicity by inhibiting DNA damage and oxidative stress. *Int J Radiat Biol* 2014;90:275-83.
143. Shi S, Wang G, Wang Y, Zhang L, Zhang L. Protective effect of nitric oxide against oxidative stress under ultraviolet-B radiation. *Nitric Oxide* 2005;13:1-9.
144. Shirazi A, Mihandoost E, Mohseni M, Ghazi-Khansari M, Rabie Mahdavi S. Radio-protective effects of melatonin against irradiation-induced oxidative damage in rat peripheral blood. *Phys Med* 2013;29:65-74.
145. Simko M. Cell type specific redox status is responsible for diverse electromagnetic field effects. *Curr Med Chem* 2007;14:1141-52.
146. Simko M, Droste S, Kriehuber R, Weiss DG. Stimulation of phagocytosis and free radical production in murine macrophages by 50 Hz electromagnetic fields. *Eur J Cell Biol* 2001;80:562-6.
147. Sirerol JA, Feddi F, Mena S, et al. Topical treatment with pterostilbene, a natural phytoalexin, effectively protects hairless mice against UVB radiation-induced skin damage and carcinogenesis. *Free Radic Biol Med* 2015;85:1-11.
148. Smith-Pearson PS, Kooshki M, Spitz DR, Poole LB, Zhao W, Robbins ME. Decreasing peroxiredoxin II expression decreases glutathione, alters cell cycle distribution, and sensitizes glioma cells to ionizing radiation and H(2)O(2). *Free Radic Biol Med* 2008;45:1178-89.
149. Song L, Wang D, Cui X, Hu W. The protective action of taurine and L-arginine in radiation pulmonary fibrosis. *J Environ Pathol Toxicol Oncol* 1998;17:151-7.
150. Stevens RG. Electromagnetic fields and free radicals. *Environ Health Perspect* 2004;112:A726; author reply A.
151. Taysi S, Koc M, Buyukokuroglu ME, Altinkaynak K, Sahin YN. Melatonin reduces lipid peroxidation and nitric oxide during irradiation-induced oxidative injury in the rat liver. *J Pineal Res* 2003;34:173-7.
152. Thotala D, Chetyrkin S, Hudson B, Hallahan D, Voziyan P, Yazlovitskaya E. Pyridoxamine protects intestinal epithelium from ionizing radiation-induced apoptosis. *Free Radic Biol Med* 2009;47:779-85.
153. Tofani S, Barone D, Berardelli M, et al. Static and ELF magnetic fields enhance the in vivo anti-tumor efficacy of cis-platin against lewis lung carcinoma, but not of cyclophosphamide against B16 melanotic melanoma. *Pharmacol Res* 2003;48:83-90.
154. Tulard A, Hoffschir F, de Boisferon FH, Luccioni C, Bravard A. Persistent oxidative stress after ionizing radiation is involved in inherited radiosensitivity. *Free Radic Biol Med* 2003;35:68-77.



155. Tunez I, Drucker-Colin R, Jimena I, et al. Transcranial magnetic stimulation attenuates cell loss and oxidative damage in the striatum induced in the 3-nitropropionic model of Huntington's disease. *J Neurochem* 2006;97:619-30.
156. von Deutsch AW, Mitchell CD, Williams CE, et al. Polyamines protect against radiation-induced oxidative stress. *Gravit Space Biol Bull* 2005;18:109-10.
157. Vujaskovic Z, Batinic-Haberle I, Rabbani ZN, et al. A small molecular weight catalytic metalloporphyrin antioxidant with superoxide dismutase (SOD) mimetic properties protects lungs from radiation-induced injury. *Free Radic Biol Med* 2002;33:857-63.
158. Wolf FI, Torsello A, Tedesco B, et al. 50-Hz extremely low frequency electromagnetic fields enhance cell proliferation and DNA damage: possible involvement of a redox mechanism. *Biochim Biophys Acta* 2005;1743:120-9.
159. Xu Y, Parmar K, Du F, Price BD, Sun Y. The radioprotective agent WR1065 protects cells from radiation damage by regulating the activity of the Tip60 acetyltransferase. *Int J Biochem Mol Biol* 2011;2:295-302.
160. Yakymenko I, Tsybulin O, Sidorik E, Henshel D, Kyrylenko O, Kyrylenko S. Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. *Electromagn Biol Med* 2015;35:186-202.
161. Yang Y, Li B, Liu C, et al. Hydrogen-rich saline protects immunocytes from radiation-induced apoptosis. *Med Sci Monit* 2012;18:BR144-8.
162. Yokoyama H, Sato T, Ogata T, Ohya-Nishiguchi H, Kamada H. In vivo longitudinally detected ESR measurements at microwave regions of 300, 700, and 900 MHz in rats treated with a nitroxide radical. *J Magn Reson* 1997;129:201-6.
163. Yokus B, Cakir DU, Akdag MZ, Sert C, Mete N. Oxidative DNA damage in rats exposed to extremely low frequency electro magnetic fields. *Free Radic Res* 2005;39:317-23.
164. Yoshida T, Goto S, Kawakatsu M, Urata Y, Li TS. Mitochondrial dysfunction, a probable cause of persistent oxidative stress after exposure to ionizing radiation. *Free Radic Res* 2012;46:147-53.
165. Yoshikawa T, Tanigawa M, Tanigawa T, Imai A, Hongo H, Kondo M. Enhancement of nitric oxide generation by low frequency electromagnetic field. *Pathophysiology* 2000;7:131-5.
166. Zhang R, Kang KA, Piao MJ, et al. Eckol protects V79-4 lung fibroblast cells against gamma-ray radiation-induced apoptosis via the scavenging of reactive oxygen species and inhibiting of the c-Jun NH(2)-terminal kinase pathway. *Eur J Pharmacol* 2008;591:114-23.
167. Zhou BR, Yin HB, Xu Y, et al. Baicalin protects human skin fibroblasts from ultraviolet A radiation-induced oxidative damage and apoptosis. *Free Radic Res* 2012;46:1458-71.
168. Zhu W, Xu J, Ge Y, et al. Epigallocatechin-3-gallate (EGCG) protects skin cells from ionizing radiation via heme oxygenase-1 (HO-1) overexpression. *J Radiat Res* 2014;55:1056-65.
169. Zmyslony M, Palus J, Dziubaltowska E, et al. Effects of in vitro exposure to power frequency magnetic fields on UV-induced DNA damage of rat lymphocytes. *Bioelectromagnetics* 2004;25:560-2.
170. Zmyslony M, Politanski P, Rajkowska E, Szymczak W, Jajte J. Acute exposure to 930 MHz CW electromagnetic radiation in vitro affects reactive oxygen species level in rat lymphocytes treated by iron ions. *Bioelectromagnetics* 2004;25:324-8.
171. Zmyslony M, Rajkowska E, Mamrot P, Politanski P, Jajte J. The effect of weak 50 Hz magnetic fields on the number of free oxygen radicals in rat lymphocytes in vitro. *Bioelectromagnetics* 2004;25:607-12.



172. Petty RK, Harding AE, Morgan-Hughes JA. The clinical features of mitochondrial myopathy. *Brain* 1986;109 (Pt 5):915-38.
173. Frantseva MV, Velazquez JL, Hwang PA, Carlen PL. Free radical production correlates with cell death in an in vitro model of epilepsy. *Eur J Neurosci* 2000;12:1431-9.
174. DiMauro S, Andreu AL, De Vivo DC. Mitochondrial disorders. *J Child Neurol* 2002;17 Suppl 3:3S35-45; discussion 3S6-7.
175. Marin-Garcia J, Goldenthal MJ, Filiano JJ. Cardiomyopathy associated with neurologic disorders and mitochondrial phenotype. *J Child Neurol* 2002;17:759-65.
176. Kouchaki E, Motaghedifard M, Banafshe HR. Effect of mobile phone radiation on pentylentetrazole-induced seizure threshold in mice. *Iran J Basic Med Sci* 2016;19:800-3.
177. Madmani ME, Yusuf Solaiman A, Tamr Agha K, et al. Coenzyme Q10 for heart failure. *Cochrane Database Syst Rev* 2014;6:CD008684.
178. Taub PR, Ramirez-Sanchez I, Ciaraldi TP, et al. Alterations in skeletal muscle indicators of mitochondrial structure and biogenesis in patients with type 2 diabetes and heart failure: effects of epicatechin rich cocoa. *Clin Transl Sci* 2012;5:43-7.
179. Indik JH, Goldman S, Gaballa MA. Oxidative stress contributes to vascular endothelial dysfunction in heart failure. *Am J Physiol Heart Circ Physiol* 2001;281:H1767-70.
180. Sharma R, Davidoff MN. Oxidative stress and endothelial dysfunction in heart failure. *Congest Heart Fail* 2002;8:165-72.
181. Wolfram R, Oguogho A, Palumbo B, Sinzinger H. Enhanced oxidative stress in coronary heart disease and chronic heart failure as indicated by an increased 8-epi-PGF(2alpha). *Eur J Heart Fail* 2005;7:167-72.
182. White M, Ducharme A, Ibrahim R, et al. Increased systemic inflammation and oxidative stress in patients with worsening congestive heart failure: improvement after short-term inotropic support. *Clin Sci (Lond)* 2006.
183. Kang D, Hamasaki N. Alterations of mitochondrial DNA in common diseases and disease states: aging, neurodegeneration, heart failure, diabetes, and cancer. *Curr Med Chem* 2005;12:429-41.
184. Kerimoglu G, Mercantepe T, Erol, H.S.
Turgut, A, Kaya H, Colakoglu S, Odaci E. Effects of long term exposure to 900 megahertz electromagnetic field on heart morphology and biochemistry of male adolescent rats. *Biotech Histochem* 2016;Aug 11: 1-10 {Epub ahead of print}.
185. Finsterer J. Cognitive decline as a manifestation of mitochondrial disorders (mitochondrial dementia). *J Neurol Sci* 2008;272:20-33.
186. Reiter RJ, Tan DX, Pappolla MA. Melatonin relieves the neural oxidative burden that contributes to dementias. *Ann N Y Acad Sci* 2004;1035:179-96.
187. Popescu BO, Toescu EC, Popescu LM, et al. Blood-brain barrier alterations in ageing and dementia. *J Neurol Sci* 2009;283:99-106.
188. Pappolla MA, Chyan YJ, Poeggeler B, et al. Alzheimer beta protein mediated oxidative damage of mitochondrial DNA: prevention by melatonin. *J Pineal Res* 1999;27:226-9.
189. Matsubara E, Bryant-Thomas T, Pacheco Quinto J, et al. Melatonin increases survival and inhibits oxidative and amyloid pathology in a transgenic model of Alzheimer's disease. *J Neurochem* 2003;85:1101-8.



190. Feng Z, Qin C, Chang Y, Zhang JT. Early melatonin supplementation alleviates oxidative stress in a transgenic mouse model of Alzheimer's disease. *Free Radic Biol Med* 2006;40:101-9.
191. Nittby H, Grafstrom G, Tian DP, et al. Cognitive impairment in rats after long-term exposure to GSM-900 mobile phone radiation. *Bioelectromagnetics* 2007.
192. Kim JY, Kim HJ, Kwon KN, Park MJ. Effects of radiofrequency field exposure on glutamate-induced oxidative stress in mouse hippocampal HT22 cells. *Int J Radiat Biol* 2016;Sept 20:1-22 {Epub ahead of print}.
193. Mugunthan N, Shanmugasamy K, Anbalagan J, Rajanarayanan S, Meenachi S. Effects of long term exposure of 900/1800 MHz radiation emitted from 2G mobile phone on mice hippocampus - A histomorphometric study. *J Clin Diagn Res* 2016;10:AF01-6.
194. Killin LOJ, Starr JM, Shiue IJ, Russ TC. Environmental risk factors for dementia: a systematic review. *BMC Geriatrics* 2016;12 Oct:DOI: 10.1186/s12877-016-0342-y.
195. Sonmez OF, Odaci E, Bas O, Kaplan S. Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field. *Brain Res* 2010;1356:95-101.
196. Herbert MR, Sage C. Autism and EMF? Plausibility of a pathophysiological link – Part I. *Pathophysiology* 2013;20:191-209.
197. Zueva NA, Kovalenko AN, Gerasimenko TI, Man'kovskii BN, Korpachova TI, Efimov AS. [Analysis of irradiation dose, body mass index and insulin blood concentration in personnel cleaning up after the Chernobyl nuclear plant accident]. *Lik Sprava* 2001:26-8.
198. Grigor'ev Iu G, Grigor'ev OA, Ivanov AA, et al. [Autoimmune processes after long-term low-level exposure to electromagnetic fields (the results of an experiment). Part 1. Mobile communications and changes in electromagnetic conditions for the population. Needs for additional substantiation of the existing hygienic standards]. *Radiats Biol Radioecol* 2010;50:6-11.
199. Grigor'ev Iu G, Grigor'ev OA, Merkulov AV, Shafirkin AV, Vorob'ev AA. [Autoimmune processes after long-term low-level exposure to electromagnetic fields (the results of an experiment). Part 2. General scheme and conditions of the experiment. Development of RF exposure conditions complying with experimental tasks. Animal's status during the long-term exposure]. *Radiats Biol Radioecol* 2010;50:12-6.
200. Grigor'ev Iu G, Shafirkin AV, Nosocskii AM. [New data for proving the presence of significant effects of electromagnetic exposure (to autoimmune changes in rats)]. *Radiats Biol Radioecol* 2011;51:721-30.
201. Brainard GC, Kavet R, Kheifets LI. The relationship between electromagnetic field and light exposures to melatonin and breast cancer risk: a review of the relevant literature. *J Pineal Res* 1999;26:65-100.
202. Milham S. A cluster of male breast cancer in office workers. *Am J Ind Med* 2004;46:86-7.
203. Milham S, Ossiander E. Electric typewriter exposure and increased female breast cancer mortality in typists. *Med Hypotheses* 2007;68:450-1.
204. Naziroglu M, Tokat S, Demirci S. Role of melatonin on electromagnetic radiation-induced oxidative stress and Ca²⁺ signaling molecular pathways in breast cancer. *J Recept Signal Transduct Res* 2012;32:290-7.
205. Zhao G, Lin X, Zhou M, Zhao J. Relationship between exposure to extremely low-frequency electromagnetic fields and breast cancer risk: a meta-analysis. *Eur J Gynaecol Oncol* 2014;35:264-9.
206. Coureau G, Bouvier G, Lebailly P, et al. Mobile phone use and brain tumours in the CERENAT case-control study. *Occup Environ Med*;71:514-22.



207. Carlberg M, Hardell L. Decreased survival of glioma patients with astrocytoma grade IV (glioblastoma multiforme) associated with long-term use of mobile and cordless phones. *Int J Environ Res Public Health* 2014;11:10790-805.
208. Carlberg M, Hardell L. Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation. *Biomed Res Int* 2017;2017:9218486.
209. Carlberg M, Koppel T, Ahonen M, Hardell L. Case-control study on occupational exposure to extremely low-frequency electromagnetic fields and glioma risk. *Am J Ind Med* 2017;April 10 (epub ahead of print).
210. Carlberg M, Hardell L. Evaluation of mobile phone and cordless phone use and glioma risk using the Bradford Hill viewpoints from 1965 on. Association or causation? *Biomed Res Int* 2017;Epub Mar 16:<https://www.hindawi.com/journals/bmri/2017/9218486/>
211. Hardell L, Carlberg M, Hansson Mild K. Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. *Pathophysiology* 2013;20:85-110.
212. Hardell L, Carlberg M, Soderqvist F, Mild KH. Pooled analysis of case-control studies on acoustic neuroma diagnosed 1997-2003 and 2007-2009 and use of mobile and cordless phones. *Int J Oncol* 2013;43:1036-44.
213. Hardell L, Carlberg M. Use of mobile and cordless phones and survival of patients with glioma. *Neuroepidemiology* 2013;40:101-8.
214. Hardell L, Carlberg M. Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones. *Rev Environ Health* 2013;28:97-106.
215. Hardell L, Carlberg M, Hansson Mild K. Pooled analysis of case-control studies on malignant brain tumours and the use of mobile and cordless phones including living and deceased subjects. *Int J Oncol* 2011;38:1465-74.
216. Hardell L, Carlberg M, Soderqvist F, Mild KH. Case-control study of the association between malignant brain tumours diagnosed between 2007 and 2009 and mobile and cordless phone use. *Int J Oncol* 2013;43:1833-45.
217. Hardell L, Carlberg M. Mobile phone and cordless phone use and the risk for glioma - Analysis of pooled case-control studies in Sweden, 1997-2003 and 2007-2009. *Pathophysiology* 2015;22:1-13.
218. Lerchl A, Kruger H, Niehaus M, Streckert JR, Bitz AK, Hansen V. Effects of mobile phone electromagnetic fields at nonthermal SAR values on melatonin and body weight of Djungarian hamsters (*Phodopus sungorus*). *J Pineal Res* 2008;44:267-72.
219. Lerchl A, Klose M, Grote K, et al. Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans. *Biochem Biophys Res Commun* 2015;459:585-90.
220. Adams JA, Galloway TS, Mondal D, Esteves SC, Mathews F. Effect of mobile telephones on sperm quality: a systematic review and meta-analysis. *Environ Int* 2014;70:106-12.
221. Houston BJ, Nixon B, King BV, De Julis GN, Aitken RJ. The effects of radiofrequency electromagnetic radiation on sperm function. *Reproduction* 2016;152:R263-R76.
222. Atasoy HI, Gunal MY, Atasoy P, Elgun S, Bugdayci G. Immunohistopathologic demonstration of deleterious effects on growing rat testes of radiofrequency waves emitted from conventional Wi-Fi devices. *J Pediatr Urol*;9:223-9.



223. Abeleva EA. [Changes of the Nature of Radiation-Induced Mutation in Spermatids of *Drosophila* under the Influence of Arginine]. *Radiobiologia* 1964;4:426-31.
224. Hong R, Zhang Y, Liu Y, Weng EQ. [Effects of extremely low frequency electromagnetic fields on DNA of testicular cells and sperm chromatin structure in mice]. *Zhonghua Lao Dong Wei Sheng Zhi Ye Bing Za Zhi* 2005;23:414-7.
225. Ugras MY, Kurus M, Ates B, Soylemez H, Otlu A, Yilmaz I. *Prunus armeniaca* L (apricot) protects rat testes from detrimental effects of low-dose x-rays. *Nutr Res* 2010;30:200-8.
226. Den Boer PJ, van Loon AA, Mackenbach P, van der Schans GP, Grootegoed JA. Effect of glutathione depletion on the cytotoxicity of xenobiotics and induction of single-strand DNA breaks by ionizing radiation in isolated hamster round spermatids. *Journal of reproduction and fertility* 1990;88:259-69.
227. Liu C, Duan W, Xu S, et al. Exposure to 1800 MHz radiofrequency electromagnetic radiation induces oxidative DNA base damage in a mouse spermatocyte-derived cell line. *Toxicol Lett* 2013;218:2-9.
228. Yan JG, Agresti M, Bruce T, Yan YH, Granlund A, Matloub HS. Effects of cellular phone emissions on sperm motility in rats. *Fertil Steril* 2007;88:957-64.
229. Aitken RJ, Bennetts LE, Sawyer D, Wiklendt AM, King BV. Impact of radio frequency electromagnetic radiation on DNA integrity in the male germline. *Int J Androl* 2005;28:171-9.
230. Guler G, Tomruk A, Ozgur E, Seyhan N. The effect of radiofrequency radiation on DNA and lipid damage in non-pregnant and pregnant rabbits and their newborns. *Gen Physiol Biophys* 2010;29:59-66.
231. Borhani N, Rajaei F, Salehi Z, Javadi A. Analysis of DNA fragmentation in mouse embryos exposed to an extremely low-frequency electromagnetic field. *Electromagn Biol Med* 2011;30:246-52.
232. Sedeghi T, Ahmadi A, Javadian M, et al. Preterm birth among women living within 600 meters of high voltage overhead power lines: a case-control study. *Rom J Intern Med* 2017;Apr 18:{Epub ahead of print}.
233. Bahreymi Toossi MH, Sadeghnia HR, Mohammad Mahdizadeh Feyzabadi M, et al. Exposure to mobile phone (900-1800 MHz) during pregnancy: tissue oxidative stress after childbirth. *J Matern Fetal Neonatal Med* 2017;Apr 23 {Epub ahead of print}:1-6.
234. Sudan M, Kheifets L, Arah O, Olsen J, Zeltzer L. Prenatal and Postnatal Cell Phone Exposures and Headaches in Children. *Open Pediatr Med Journal* 2012;6:46-52.
235. Aldad TS, Gan G, Gao XB, Taylor HS. Fetal radiofrequency radiation exposure from 800-1900 mhz-rated cellular telephones affects neurodevelopment and behavior in mice. *Sci Rep*;2:312.
236. Shahin S, Singh VP, Shukla RK, et al. 2.45 GHz microwave irradiation-induced oxidative stress affects implantation or pregnancy in mice, *Mus musculus*. *Appl Biochem Biotechnol* 2013;169:1727-51.
237. Othman H, Ammari M, Sakly M, Abdelmelek H. Effects of prenatal exposure to WiFi signal on postnatal development and behavior in rat: Influence of maternal restraint. *Behavioral Brain Research* 2017;36:291-302.
238. Zarei S, Mortazavi SMJ, Mehdizadeh AR, et al. A Challenging Issue in the Etiology of Speech Problems: The Effect of Maternal Exposure to Electromagnetic Fields on Speech Problems in the Offspring. *Journal of Biomedical Physics & Engineering* 2015;5:151-4.
239. Divan HA, Kheifets L, Obel C, Olsen J. Prenatal and postnatal exposure to cell phone use and behavioral problems in children. *Epidemiology* 2008;19:523-9.



240. Divan HA, Kheifets L, Obel C, Olsen J. Cell phone use and behavioural problems in young children. *J Epidemiol Community Health* 2012;66:524-9.
241. Birks L, Guxens M, Papadopoulou E, et al. Maternal cell phone use during pregnancy and child behavioral problems in five birth cohorts. *Environment International* 2017.
242. Reiter RJ. Alterations of the circadian melatonin rhythm by the electromagnetic spectrum: a study in environmental toxicology. *Regul Toxicol Pharmacol* 1992;15:226-44.
243. Reiter RJ. Static and extremely low frequency electromagnetic field exposure: reported effects on the circadian production of melatonin. *J Cell Biochem* 1993;51:394-403.
244. Reiter RJ. Electromagnetic fields and melatonin production. *Biomed Pharmacother* 1993;47:439-44.
245. Reiter RJ. Melatonin suppression by static and extremely low frequency electromagnetic fields: relationship to the reported increased incidence of cancer. *Rev Environ Health* 1994;10:171-86.
246. Fernie KJ, Bird DM, Petittlerc D. Effects of electromagnetic fields on photophasic circulating melatonin levels in American kestrels. *Environ Health Perspect* 1999;107:901-4.
247. Griefahn B, Kunemund C, Blaszkewicz M, Lerchl A, Degen GH. Effects of electromagnetic radiation (bright light, extremely low-frequency magnetic fields, infrared radiation) on the circadian rhythm of melatonin synthesis, rectal temperature, and heart rate. *Ind Health* 2002;40:320-7.
248. Jarupat S, Kawabata A, Tokura H, Borkiewicz A. Effects of the 1900 MHz electromagnetic field emitted from cellular phone on nocturnal melatonin secretion. *J Physiol Anthropol Appl Human Sci* 2003;22:61-3.
249. [Melatonin in the environmental medicine diagnosis in connection with electromagnetic fields: statement of the commission "Methods and Quality Assurance in Environmental Medicine"]. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2005;48:1406-8.
250. Rapoport SI, Breus TK. [Melatonin as a most important factor of natural electromagnetic fields impacting patients with hypertensive disease and coronary heart disease. Part 1]. *Klin Med (Mosk)* 2011;89:9-14.
251. Dyche J, Anch AM, Fogler KA, Barnett DW, Thomas C. Effects of power frequency electromagnetic fields on melatonin and sleep in the rat. *Emerg Health Threats J* 2012;5.
252. Qin F, Zhang J, Cao H, et al. Effects of 1800-MHz radiofrequency fields on circadian rhythm of plasma melatonin and testosterone in male rats. *J Toxicol Environ Health A* 2012;75:1120-8.
253. Bagchi M, Balmoori J, Ye X, Bagchi D, Ray SD, Stohs SJ. Protective effect of melatonin on naphthalene-induced oxidative stress and DNA damage in cultured macrophage J774A.1 cells. *Mol Cell Biochem* 2001;221:49-55.
254. Abdel Moneim AE, Ortiz F, Leonardo-Mendonca RC, et al. Protective effects of melatonin against oxidative damage induced by Egyptian cobra (*Naja haje*) crude venom in rats. *Acta Trop* 2015;143:58-65.
255. Abd-Elghaffar S, El-Sokkary GH, Sharkawy AA. Aluminum-induced neurotoxicity and oxidative damage in rabbits: protective effect of melatonin. *Neuro Endocrinol Lett* 2005;26:609-16.
256. Abdel-Wahab MH, Arafa HM, El-Mahdy MA, Abdel-Naim AB. Potential protective effect of melatonin against dibromoacetonitrile-induced oxidative stress in mouse stomach. *Pharmacol Res* 2002;46:287-93.
257. Abdel-Wahhab MA, Abdel-Galil MM, El-Lithey M. Melatonin counteracts oxidative stress in rats fed an ochratoxin A contaminated diet. *J Pineal Res* 2005;38:130-5.
258. Abraham P, Kolli VK, Rabi S. Melatonin attenuates methotrexate-induced oxidative stress and renal damage in rats. *Cell Biochem Funct* 2010;28:426-33.



259. Agil A, Reiter RJ, Jimenez-Aranda A, et al. Melatonin ameliorates low-grade inflammation and oxidative stress in young Zucker diabetic fatty rats. *J Pineal Res* 2013;54:381-8.
260. Aksoy N, Vural H, Sabuncu T, Aksoy S. Effects of melatonin on oxidative-antioxidative status of tissues in streptozotocin-induced diabetic rats. *Cell Biochem Funct* 2003;21:121-5.
261. Aktas C, Kanter M, Erboga M, Mete R, Oran M. Melatonin attenuates oxidative stress, liver damage and hepatocyte apoptosis after bile-duct ligation in rats. *Toxicol Ind Health* 2014;30:835-44.
262. Albendea CD, Gomez-Trullen EM, Fuentes-Broto L, et al. Melatonin reduces lipid and protein oxidative damage in synaptosomes due to aluminium. *J Trace Elem Med Biol* 2007;21:261-8.
263. Al-Malki AL. Synergistic effect of lycopene and melatonin against the genesis of oxidative stress induced by cyclophosphamide in rats. *Toxicol Ind Health* 2014;30:570-5.
264. Aranda M, Albendea CD, Lostale F, et al. In vivo hepatic oxidative stress because of carbon tetrachloride toxicity: protection by melatonin and pinoline. *J Pineal Res* 2010;49:78-85.
265. Arushanian EB. [Limitation of oxidative stress as the main factor of the universal protective properties of melatonin]. *Eksp Klin Farmakol* 2012;75:44-9.
266. Bagheri F, Goudarzi I, Lashkarbolouki T, Elahdadi Salmani M. Melatonin prevents oxidative damage induced by maternal ethanol administration and reduces homocysteine in the cerebellum of rat pups. *Behav Brain Res* 2015;287:215-25.
267. Aynali G, Naziroglu M, Celik O, Dogan M, Yariktas M, Yasan H. Modulation of wireless (2.45 GHz)-induced oxidative toxicity in laryngotracheal mucosa of rat by melatonin. *Eur Arch Otorhinolaryngol* 2013;270:1695-700.
268. Bardak Y, Ozerturk Y, Ozguner F, Durmus M, Delibas N. Effect of melatonin against oxidative stress in ultraviolet-B exposed rat lens. *Curr Eye Res* 2000;20:225-30.
269. Argun M, Tok L, Uguz AC, Celik O, Tok OY, Naziroglu M. Melatonin and amfenac modulate calcium entry, apoptosis, and oxidative stress in ARPE-19 cell culture exposed to blue light irradiation (405 nm). *Eye (Lond)* 2014;28:752-60.
270. Ayata A, Mollaoglu H, Yilmaz HR, Akturk O, Ozguner F, Altuntas I. Oxidative stress-mediated skin damage in an experimental mobile phone model can be prevented by melatonin. *J Dermatol* 2004;31:878-83.
271. Bhatia AL, Manda K. Study on pre-treatment of melatonin against radiation-induced oxidative stress in mice. *Environ Toxicol Pharmacol* 2004;18:13-20.
272. Guney Y, Hicsonmez A, Uluoglu C, et al. Melatonin prevents inflammation and oxidative stress caused by abdominopelvic and total body irradiation of rat small intestine. *Braz J Med Biol Res* 2007;40:1305-14.
273. Jang SS, Kim HG, Lee JS, et al. Melatonin reduces X-ray radiation-induced lung injury in mice by modulating oxidative stress and cytokine expression. *Int J Radiat Biol* 2013;89:97-105.
274. Kim BC, Shon BS, Ryoo YW, Kim SP, Lee KS. Melatonin reduces X-ray irradiation-induced oxidative damages in cultured human skin fibroblasts. *J Dermatol Sci* 2001;26:194-200.
275. Koc M, Taysi S, Buyukokuroglu ME, Bakan N. Melatonin protects rat liver against irradiation-induced oxidative injury. *J Radiat Res* 2003;44:211-5.
276. Manda K, Ueno M, Anzai K. Melatonin mitigates oxidative damage and apoptosis in mouse cerebellum induced by high-LET 56Fe particle irradiation. *J Pineal Res* 2008;44:189-96.



277. Naziroglu M, Celik O, Ozgul C, et al. Melatonin modulates wireless (2.45 GHz)-induced oxidative injury through TRPM2 and voltage gated Ca(2+) channels in brain and dorsal root ganglion in rat. *Physiol Behav* 2012;105:683-92.
278. Oksay T, Naziroglu M, Dogan S, Guzel A, Gumral N, Kosar PA. Protective effects of melatonin against oxidative injury in rat testis induced by wireless (2.45 GHz) devices. *Andrologia* 2012.
279. Sener G, Atasoy BM, Ersoy Y, Arbak S, Sengoz M, Yegen BC. Melatonin protects against ionizing radiation-induced oxidative damage in corpus cavernosum and urinary bladder in rats. *J Pineal Res* 2004;37:241-6.
280. Sharma S, Haldar C. Melatonin prevents X-ray irradiation induced oxidative damage in peripheral blood and spleen of the seasonally breeding rodent, *Funambulus pennanti* during reproductively active phase. *Int J Radiat Biol* 2006;82:411-9.
281. Sokolovic D, Djindjic B, Nikolic J, et al. Melatonin reduces oxidative stress induced by chronic exposure of microwave radiation from mobile phones in rat brain. *J Radiat Res* 2008;49:579-86.
282. Taysi S, Memisogullari R, Koc M, et al. Melatonin reduces oxidative stress in the rat lens due to radiation-induced oxidative injury. *Int J Radiat Biol* 2008;84:803-8.
283. Tok L, Naziroglu M, Dogan S, Kahya MC, Tok O. Effects of melatonin on Wi-Fi-induced oxidative stress in lens of rats. *Indian J Ophthalmol* 2014;62:12-5.
284. Yilmaz S, Yilmaz E. Effects of melatonin and vitamin E on oxidative-antioxidative status in rats exposed to irradiation. *Toxicology* 2006;222:1-7.
285. Albers DS, Beal MF. Mitochondrial dysfunction and oxidative stress in aging and neurodegenerative disease. *J Neural Transm Suppl* 2000;59:133-54.
286. Ansari MA, Joshi G, Huang Q, et al. In vivo administration of D609 leads to protection of subsequently isolated gerbil brain mitochondria subjected to in vitro oxidative stress induced by amyloid beta-peptide and other oxidative stressors: relevance to Alzheimer's disease and other oxidative stress-related neurodegenerative disorders. *Free Radic Biol Med* 2006;41:1694-703.
287. Arumugam S, Thandavarayan RA, Arozal W, et al. Quercetin offers cardioprotection against progression of experimental autoimmune myocarditis by suppression of oxidative and endoplasmic reticulum stress via endothelin-1/MAPK signalling. *Free Radic Res* 2012;46:154-63.
288. Barnham KJ, Masters CL, Bush AI. Neurodegenerative diseases and oxidative stress. *Nat Rev Drug Discov* 2004;3:205-14.
289. Bashir S, Harris G, Denman MA, Blake DR, Winyard PG. Oxidative DNA damage and cellular sensitivity to oxidative stress in human autoimmune diseases. *Ann Rheum Dis* 1993;52:659-66.
290. Belch JJ, Mackay IR, Hill A, Jennings P, McCollum P. Oxidative stress is present in atherosclerotic peripheral arterial disease and further increased by diabetes mellitus. *Int Angiol* 1995;14:385-8.
291. Benz CC, Yau C. Ageing, oxidative stress and cancer: paradigms in parallax. *Nat Rev Cancer* 2008;8:875-9.
292. Bernstein AI, Miller GW. Oxidative signaling in experimental autoimmune encephalomyelitis. *Toxicol Sci* 2010;114:159-61.
293. Bonnefont-Rousselot D. Obesity and oxidative stress: potential roles of melatonin as antioxidant and metabolic regulator. *Endocr Metab Immune Disord Drug Targets* 2014;14:159-68.
294. Butterfield DA, Castegna A, Drake J, Scapagnini G, Calabrese V. Vitamin E and neurodegenerative disorders associated with oxidative stress. *Nutr Neurosci* 2002;5:229-39.



295. Butterfield DA, Howard BJ, LaFontaine MA. Brain oxidative stress in animal models of accelerated aging and the age-related neurodegenerative disorders, Alzheimer's disease and Huntington's disease. *Curr Med Chem* 2001;8:815-28.
296. Ceriello A, Motz E. Is oxidative stress the pathogenic mechanism underlying insulin resistance, diabetes, and cardiovascular disease? The common soil hypothesis revisited. *Arterioscler Thromb Vasc Biol* 2004;24:816-23.
297. Chang YC, Chuang LM. The role of oxidative stress in the pathogenesis of type 2 diabetes: from molecular mechanism to clinical implication. *Am J Transl Res* 2010;2:316-31.
298. Chauhan A, Chauhan V. Oxidative stress in autism. *Pathophysiology* 2006;13:171-81.
299. Chauhan A, Chauhan V, Brown WT, Cohen I. Oxidative stress in autism: increased lipid peroxidation and reduced serum levels of ceruloplasmin and transferrin--the antioxidant proteins. *Life Sci* 2004;75:2539-49.
300. Dhaun N, Kluth DC. Oxidative stress promotes hypertension and albuminuria during the autoimmune disease systemic lupus erythematosus. *Hypertension* 2012;59:e47; author reply e8.
301. Dobrian AD, Davies MJ, Schriver SD, Lauterio TJ, Prewitt RL. Oxidative stress in a rat model of obesity-induced hypertension. *Hypertension* 2001;37:554-60.
302. Donkena KV, Young CY, Tindall DJ. Oxidative stress and DNA methylation in prostate cancer. *Obstet Gynecol Int* 2010;2010:302051.
303. Facheris M, Beretta S, Ferrarese C. Peripheral markers of oxidative stress and excitotoxicity in neurodegenerative disorders: tools for diagnosis and therapy? *J Alzheimers Dis* 2004;6:177-84.
304. Gilgun-Sherki Y, Melamed E, Offen D. Oxidative stress induced-neurodegenerative diseases: the need for antioxidants that penetrate the blood brain barrier. *Neuropharmacology* 2001;40:959-75.
305. Henriksen EJ, Diamond-Stanic MK, Marchionne EM. Oxidative stress and the etiology of insulin resistance and type 2 diabetes. *Free Radic Biol Med* 2011;51:993-9.
306. Hoeldtke RD, Bryner KD, VanDyke K. Oxidative stress and autonomic nerve function in early type 1 diabetes. *Clin Auton Res* 2011;21:19-28.
307. Islam MT. Oxidative stress and mitochondrial dysfunction-linked neurodegenerative disorders. *Neurol Res* 2017;39:73-82.
308. James SJ, Cutler P, Melnyk S, et al. Metabolic biomarkers of increased oxidative stress and impaired methylation capacity in children with autism. *Am J Clin Nutr* 2004;80:1611-7.
309. Kaffe ET, Rigopoulou EI, Koukoulis GK, Dalekos GN, Moulas AN. Oxidative stress and antioxidant status in patients with autoimmune liver diseases. *Redox Rep* 2015;20:33-41.
310. Karbownik M, Reiter RJ. Melatonin protects against oxidative stress caused by delta-aminolevulinic acid: implications for cancer reduction. *Cancer Invest* 2002;20:276-86.
311. Karbownik M, Reiter RJ, Burkhardt S, Gitto E, Tan DX, Lewinski A. Melatonin attenuates estradiol-induced oxidative damage to DNA: relevance for cancer prevention. *Exp Biol Med (Maywood)* 2001;226:707-12.
312. Kern JK, Jones AM. Evidence of toxicity, oxidative stress, and neuronal insult in autism. *J Toxicol Environ Health B Crit Rev* 2006;9:485-99.
313. Khandrika L, Kumar B, Koul S, Maroni P, Koul HK. Oxidative stress in prostate cancer. *Cancer Lett* 2009.



314. Kovacic P, Jacintho JD. Systemic lupus erythematosus and other autoimmune diseases from endogenous and exogenous agents: unifying theme of oxidative stress. *Mini Rev Med Chem* 2003;3:568-75.
315. Kumagai S, Jikimoto T, Saegusa J. [Pathological roles of oxidative stress in autoimmune diseases]. *Rinsho Byori* 2003;51:126-32.
316. Kumagai S, Nobuhara Y, Saegusa J. [Oxidative stress and autoimmune diseases]. *Nihon Naika Gakkai Zasshi* 2003;92:1096-103.
317. Kupczyk D, Rybka J, Kedziora-Kornatowska K, Kedziora J. [Melatonin and oxidative stress in elderly patients with type 2 diabetes]. *Pol Merkur Lekarski* 2010;28:407-9.
318. Lin MT, Beal MF. Mitochondrial dysfunction and oxidative stress in neurodegenerative diseases. *Nature* 2006;443:787-95.
319. Mariani E, Polidori MC, Cherubini A, Mecocci P. Oxidative stress in brain aging, neurodegenerative and vascular diseases: an overview. *J Chromatogr B Analyt Technol Biomed Life Sci* 2005;827:65-75.
320. McGinnis WR. Oxidative stress in autism. *Altern Ther Health Med* 2005;11:19.
321. Moreno-Otero R. May oxidative stress contribute to autoimmune hepatitis pathogenesis, and can antioxidants be of value as adjuvant therapy for refractory patients? *Dig Dis Sci* 2013;58:1440-1.
322. Nguyen AM, Rao NA. Oxidative photoreceptor cell damage in autoimmune uveitis. *J Ophthalmic Inflamm Infect* 2011;1:7-13.
323. Pandi-Perumal SR, BaHammam AS, Brown GM, et al. Melatonin antioxidative defense: therapeutical implications for aging and neurodegenerative processes. *Neurotox Res* 2013;23:267-300.
324. Pereira EC, Ferderbar S, Bertolami MC, et al. Biomarkers of oxidative stress and endothelial dysfunction in glucose intolerance and diabetes mellitus. *Clin Biochem* 2008;41:1454-60.
325. Pillarisetti S, Saxena U. Role of oxidative stress and inflammation in the origin of Type 2 diabetes--a paradigm shift. *Expert Opin Ther Targets* 2004;8:401-8.
326. Rao AV, Balachandran B. Role of oxidative stress and antioxidants in neurodegenerative diseases. *Nutr Neurosci* 2002;5:291-309.
327. Rodrigues P, de Marco G, Furriol J, et al. Oxidative stress in susceptibility to breast cancer: study in Spanish population. *BMC Cancer* 2014;14:861.
328. Rose S, Melnyk S, Pavliv O, et al. Evidence of oxidative damage and inflammation associated with low glutathione redox status in the autism brain. *Transl Psychiatry* 2012;2:e134.
329. Rossignol DA, Frye RE. A review of research trends in physiological abnormalities in autism spectrum disorders: immune dysregulation, inflammation, oxidative stress, mitochondrial dysfunction and environmental toxicant exposures. *Mol Psychiatry* 2012;17:389-401.
330. Shah AA, Sinha AA. Oxidative stress and autoimmune skin disease. *Eur J Dermatol* 2013;23:5-13.
331. Sheridan J, Wang LM, Tosetto M, et al. Nuclear oxidative damage correlates with poor survival in colorectal cancer. *Br J Cancer* 2009;100:381-8.
332. Sondergaard ES, Gogenur I. [Oxidative stress may cause metastatic disease in patients with colorectal cancer.]. *Ugeskr Laeger* 2014;176.
333. Srinivasan V. Melatonin oxidative stress and neurodegenerative diseases. *Indian J Exp Biol* 2002;40:668-79.



334. Sun GY, Wood WG. Recent developments in understanding oxidative mechanisms and contributions of glial cell activation, mitochondrial dysfunction, and lipids and signaling pathways to neurodegenerative diseases. Preface. *Mol Neurobiol* 2010;41:53-4.
335. Udensi UK, Tchounwou PB. Dual effect of oxidative stress on leukemia cancer induction and treatment. *J Exp Clin Cancer Res* 2014;33:106.
336. Valko M, Rhodes CJ, Moncol J, Izakovic M, Mazur M. Free radicals, metals and antioxidants in oxidative stress-induced cancer. *Chem Biol Interact* 2006;160:1-40.
337. Vessby J, Basu S, Mohsen R, Berne C, Vessby B. Oxidative stress and antioxidant status in type 1 diabetes mellitus. *J Intern Med* 2002;251:69-76.
338. Wells PG, McCallum GP, Chen CS, et al. Oxidative stress in developmental origins of disease: teratogenesis, neurodevelopmental deficits, and cancer. *Toxicol Sci* 2009;108:4-18.
339. Yamamoto T. Autoimmune mechanisms of scleroderma and a role of oxidative stress. *Self Nonsell* 2011;2:4-10.
340. Yao Y, Walsh WJ, McGinnis WR, Pratico D. Altered vascular phenotype in autism: correlation with oxidative stress. *Arch Neurol* 2006;63:1161-4.
341. Yu JH, Kim H. Oxidative stress and cytokines in the pathogenesis of pancreatic cancer. *J Cancer Prev* 2014;19:97-102.
342. Zephy D, Ahmad J. Type 2 diabetes mellitus: Role of melatonin and oxidative stress. *Diabetes Metab Syndr* 2015;9:127-31.
343. Zoroglu SS, Armutcu F, Ozen S, et al. Increased oxidative stress and altered activities of erythrocyte free radical scavenging enzymes in autism. *Eur Arch Psychiatry Clin Neurosci* 2004;254:143-7.
344. Torbenko VP, Bogdanova IA, Gerasimov AM. [Effect of a combined radiation lesion on the enzyme activity of the glutathione redox system of the rat liver]. *Biull Eksp Biol Med* 1983;95:48-50.
345. Erden M, Bor NM. Changes of reduced glutathion, glutathion reductase, and glutathione peroxidase after radiation in guinea pigs. *Biochem Med* 1984;31:217-27.
346. Evans JW, Taylor YC, Brown JM. The role of glutathione and DNA strand break repair in determining the shoulder of the radiation survival curve. *Br J Cancer Suppl* 1984;6:49-53.
347. Boyer TD, Vessey DA, Kempner E. Radiation inactivation of microsomal glutathione S-transferase. *J Biol Chem* 1986;261:16963-8.
348. Connor MJ, Wheeler LA. Depletion of cutaneous glutathione by ultraviolet radiation. *Photochem Photobiol* 1987;46:239-45.
349. Singh LR, Uniyal BP, Mukherjee SK, Sarkar SR, Sharma SK. Effect of whole body gamma-radiation on glutathione reductase of rat tissues. *Strahlenther Onkol* 1987;163:337-9.
350. Leus NF, Kolomiichuk SG, Lishchenko VB. [Activity of glutathione-S-transferase in the blood plasma, liver and crystalline lens tissues as affected by low doses of ionizing radiation and polychromatic light]. *Ukr Biokhim Zh* 1997;69:54-9.
351. Grande S, Luciani AM, Rosi A, et al. Radiation effects on soluble metabolites in cultured HeLa cells examined by ¹H MRS: changes in concentration of glutathione and of lipid catabolites induced by gamma rays and proton beams. *Int J Cancer* 2001;96 Suppl:27-42.
352. Rathgen GH. [Radiation-induced changes of the glutathione content of some rat organs modified by cysteine]. *Strahlentherapie* 1970;139:243-50.



353. Rathgen GH, Lieser H. [Significance of glutathione in radiation effect studies and chemical radiation protection]. *Strahlentherapie* 1972;143:670-6.
354. Sarkar SR, Singh LR, Uniyal BP, Chaudhuri BN. Effect of whole body gamma radiation on reduced glutathione contents of rat tissues. *Strahlentherapie* 1983;159:32-3.
355. Rosi A, Grande S, Luciani AM, et al. Role of glutathione in apoptosis induced by radiation as determined by ¹H MR spectra of cultured tumor cells. *Radiat Res* 2007;167:268-82.
356. Tanita J, Tsuchida S, Hozawa J, Sato K. Expression of glutathione S-transferase-pi in human squamous cell carcinomas of the pharynx and larynx. Loss after radiation therapy. *Cancer* 1993;72:569-76.
357. Vartanyan LS, Gurevich SM, Kozachenko AI, Nagler LG, Lozovskaya EL, Burlakova EB. Changes in superoxide production rate and in superoxide dismutase and glutathione peroxidase activities in subcellular organelles in mouse liver under exposure to low doses of low-intensity radiation. *Biochemistry (Mosc)* 2000;65:442-6.
358. Woodward GE. The effect of ultra-violet, radium and X-ray radiation on glutathione in pure solution. *Biochem J* 1933;27:1411-4.
359. Byun YH, Ha M, Kwon HJ, et al. Mobile phone use, blood lead levels, and attention deficit hyperactivity symptoms in children: a longitudinal study. *PLoS One* 2013;8:e59742.
360. Sanie-Jahromi F, Saadat Z, Saadat M. Effects of extremely low frequency electromagnetic fields and cisplatin on mRNA levels of some DNA repair genes. *Life Sciences* 2016;3205:30588-4.