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Evidence Indicates Plausible Link between Autism and RF Radiation Exposure

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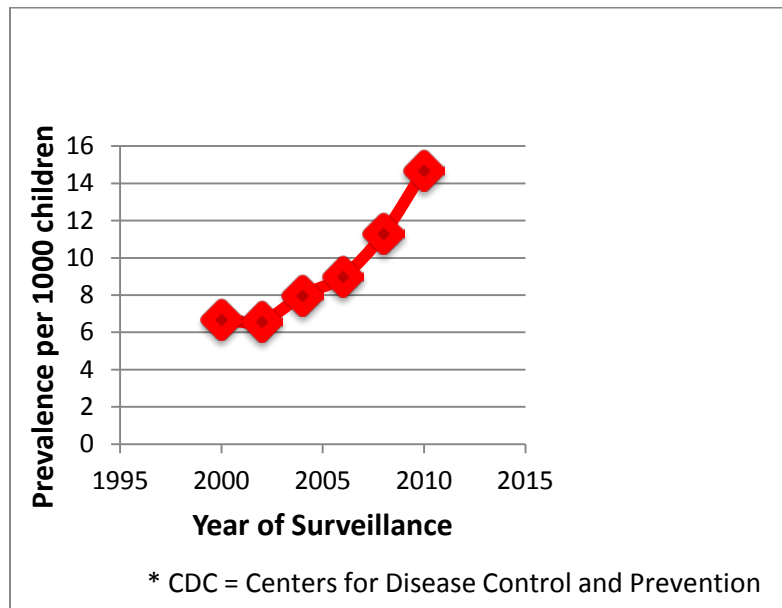
I am a board-certified neurologist, with special competency in Child Neurology and specialization in neurodevelopmental disorders, and I am a research neuroscientist. I am on the faculty of Harvard Medical School, on staff at the Massachusetts General Hospital (MGH) and an affiliate of the Harvard-MGH-MIT Martinos Center for Biomedical Imaging.

I have an extensive history of research and clinical practice in neurodevelopmental disorders, particularly autism spectrum disorders. I have published research papers in: brain imaging; physiological abnormalities in autism spectrum disorders; and environmental influences on neurodevelopmental disorders such as autism, and on brain development and function.

Increasing prevalence of Autism in the USA and its high costs

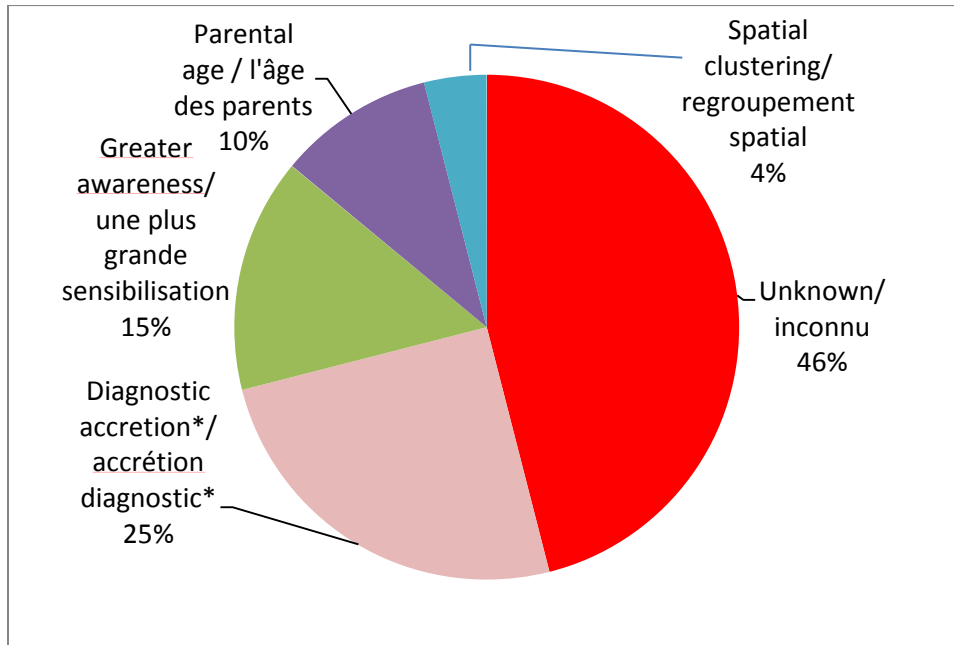
Autism spectrum disorder (ASD) diagnoses are increasing rapidly in North America, with profound effects on those affected, as well as parents, families, caregivers, communities and society at large. In the U.S. the rates have gone from 3-4 in 10,000 20 years ago to over 1 in 68 today. Annual costs for treatment of an affected child can reach \$40,000US to \$60,000US, and lifetime support can cost, with lifetime individual support costs topping \$1.2-\$3.2 million US per affected individual. This translates into approximately \$240 billion US annually in the US.

Autism Prevalence in the USA (CDC* 2014)



Many factors are associated with Autism Spectrum Disorders, with a growing number of associations of environmental exposures with autism risk and prevalence

Factors associated with ASD prevalence



*children who formerly would have been diagnosed with mental retardation

What is Autism?

It is difficult for many to imagine how autism could be influenced by environmental factors, but this difficulty comes from holding assumptions, particularly that autism is genetically hardwired into the brain. While referred to by many scientists, this assumption is not proven scientifically. More and more scientific and clinical observations suggest that we need to think about autism differently.

Autism is not a broken brain – many with autism are highly gifted, albeit with issues that are often dyspraxic – that is, problems with expression and coordination, not lack of capability.

Autism is not purely genetic – genes identified as associated with ASDs are common in healthy people, but the environment plays a big role.

Autism is not a life sentence. It is variable, changeable, treatable, and some lose the diagnosis. High intelligence is common (evidence for low intelligence, assumed to be dominant, was poor).

Autism may be centrally about brain FUNCTION. Autism may turn out to be more about impaired function than about altered brain anatomy, since the anatomical differences are subtle while the functional differences are more striking.

Autism involves not just the brain – multiple systems in the body are involved.

Autism is defined psychologically by a set of neurocognitive symptoms. Much research has identified many underlying systemic physiological disturbances, at the molecular, cellular, organ system and brain/nervous system levels. Researchers are starting to study the way these physiological, functional disturbances alter brain function.

Particularly important is the electrophysiology of the central and autonomic system nervous systems. The underlying chemistry and health of the cells in the brain and nervous system set the terms within which the brain can function.

As it turns out, the alterations in cell chemistry and physiology that have been identified in autism have virtually all been documented as effects of Electromagnetic Frequencies (EMF), including Radiofrequency Radiation (RFR).

Other environmental exposures and genetic vulnerabilities may ALSO contribute to this impairment of cell function. *The cumulative effect – the total load of these environmental stressors – is likely to be what causes autism and triggers its challenging behaviors. We can do something about the contribution of EMF.*

Might EMF contribute to the development or worsening of ASCs?

Connections between Autism and EMR

My coauthor Cindy Sage and I extensively reviewed the parallels between autism and effects of EMF, and their implications in a paper published in the peer-reviewed journal *Pathophysiology*.

Autism and EMF? Plausibility of a pathophysiological link - Part I and Part II.

[Pathophysiology](#). 2013 Jun;20(3):191-209

doi: 10.1016/j.pathophys.2013.08.001. Epub 2013 Oct 4 (more than 550 citations)

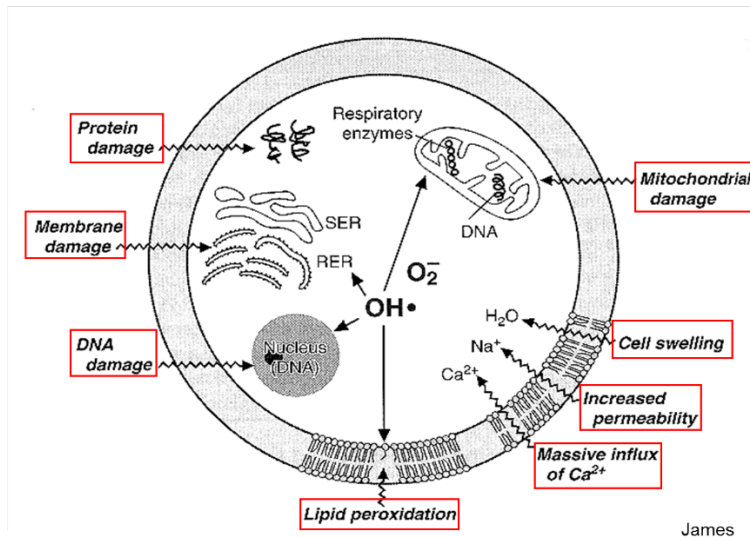
The full papers are available as item #21 on www.marthahebert.org/publications. A short summary for a lay audience is available in this publication: <http://virtualpublications.soloprinting.com/publication/?i=252361>

We delineate parallels between observed dysfunctions in ASDs, and biological effects of EMR.

Damage induced by RFR, and seen in ASDs, includes

- oxidative and cellular stress
- lipid peroxidation
- stress protein responses
- genetic alterations
- altered membrane and barrier structure/function
- calcium channel disturbances
- altered function at cell junctions (where cells connect to one another)

Injury at the cellular level throughout the body and brain



Degradation of Functional Systems both caused by EMF/RFR and present in ASDs include:

- Dysfunction in energy and metabolism, seen in the mitochondria and in altered brain glucose metabolism
- Alteration of important functions in perinatal/infancy period
- Brain cell structure alteration and damage
- Melatonin dysregulation
- Immune dysfunction
- Electrophysiological alterations

These physiological disturbances are mirrored in many other common chronic diseases

These include diabetes, cancer, obesity, hypertension, neurodegenerative disorders, and more. The cumulative cost of these conditions is enormous to the point of straining our health care systems and economics beyond tolerance.

Electrophysiological perturbations are central to ASDs, and overall effects of EMF/RFR

Altered molecular, cellular and physiological function in the brain and the body, along with altered immunity, in turn impact the electrical signaling activities of the brain and nervous system.

Electrophysiological perturbations are seen in many conditions, including seizures/epilepsy, sleep disturbances, sensory processing, cognitive efficiency and autonomic dysregulation (e.g. heart rate and stress reactivity) – and these features are all present in many or most people with autism.

These effects occur at exposure levels substantially below Safety Code 6.

Children's vulnerabilities

Children are not little adults. They are developing, and perturbations during windows of development may have life-long repercussions.

In August of 2013 the American Academy of Pediatrics addressed their concerns about the need for re-evaluating EMF/RFR given that exposure has skyrocketed, while regulations in place in the U.S. date back to 1996. The AAP expressed particular concern about the use of devices like cell phones and laptops in pregnant and nursing mothers and children. (submitted as appendix) Safety Code 6 has seen only minor modifications since being introduced in 1979.

Radiation from cell phones and other sources penetrates deeper into the heads of children (Wuart, et al. 2008. Analysis of RF exposures in the head tissues of children and adults. *Phys. Med. Biol.*). This leads to persistent stress on the cells in the brain, and over time more and more serious problems can develop.

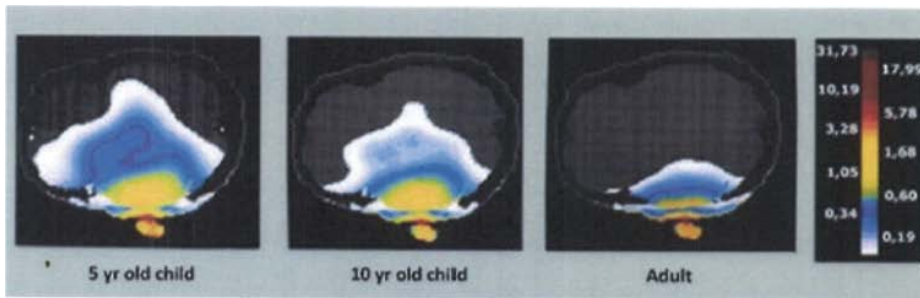


Figure 2. This figure shows SAR distributions for an adult male typical of SAM, a 10-year old child, and a 5-year old child—on the scale shown.

Frequency = 900 MHz

Reproduced from: Gandhi, O.P. et al., *Exposure Limits: The Underestimation of Absorbed Cell Phone Radiation, Especially in Children*, *Electromagnetic Biology and Medicine*, Early Online, 1-18 (2011)

Certain tissues of a child's head, e.g., the bone marrow, eye and brain tissues, absorb significantly more energy than those in an adult head, due to size of head, skull issues, tissue characteristics and geometry. (Christ, et al. 2010. Age-dependent tissue-specific exposure of cell phone users. *Phys. Med. Biol.*)

Starting to use cell phone before the age of 20 results in a 5 fold increase in glioma and acoustic neuroma. (Dr. Lennart Hardell, MD, PhD and Professor at University Hospital in Orebro, Sweden)

Many of today's children are exposed in utero and from birth, with baby monitors, cell phones, Wi-Fi, cordless phones, smart meters, etc.

EMFs are part of a bigger picture. RFR may amplify effects of other environmental exposures, perhaps via increased membrane permeability or other cellular impacts listed above. For example, among 2,422 children, cell phone use correlated with impaired behaviour only among children who had higher lead levels (lead also impairs behaviour and cognition). (Byun et al. Mobile Phone Use, Blood Lead Levels, and Attention Deficit Hyperactivity Symptoms in Children: A Longitudinal Study. *PLoS One*. 2013; 8(3): e59742.)

Conclusion

The vulnerability of children and of individuals with highly prevalent and costly illnesses should be a major consideration in discussions of EMF/RFR risks.

The evidence is sufficient to warrant new public exposure standards, benchmarked to low intensity (non-thermal) exposure levels now known to be biologically disruptive. Science cannot presently identify a “safe” level for RFR. Even as research proceeds, decisive policies and actions are required to achieve exposure levels that are As Low As Reasonably Achievable (ALARA).

Recommendations

- Strong, precautionary practices to reduce unnecessary exposures to EMF/RFR in daily life.
- A national campaign to educate Canadians about simple, practical everyday methods to minimize exposure to RF radiation.
- Minimize children’s exposures to EMR, including banning Wi-Fi in daycare centres, pre-schools and up to grade 3, ensuring Wi-Fi is off when not being used.
- Banning the marketing of wireless devices to children.