Bermuda Consultation on Environmental and Human Health Effects of 5G
Response of Environmental Health Trust
Please see additional attachments of published science.

December 7, 2020

Question: Do you agree that the Federal Communications Commission, which regulates interstate and international communications by radio, television, wire, satellite and cable within the United States, RF Exposure standards are appropriate for Bermuda? If not, what is a suitable alternative and why?

Answer: No.

Along with more than 400 independent specialists in the field, we do not think Federal Communications Commission (FCC) standards nor do we think ICNIRP reference limits protect public health and the environment in Bermuda or anywhere else. These outmoded standards based on scientific findings from the last century reflect the views of 'captured' agencies and do not take into account growing expert concerns about public health and environmental impacts of telecommunications networks, especially for the exquisitely sensitive, protected Bermudan ecosystem.

Hundreds of scientists, experts and government officials have appealed to halt 5G and reduce exposure to non ionizing radiation. For example see the 2020 Consensus Statement of UK and International Medical and Scientific Experts 3500 Medical Doctors, Switzerland Doctors for the Environment, US Doctors and Experts National 5G Resolution, International EMF Scientist Appeal, Appeal to the European Union, Belgium Doctors Appeal, Canadian Doctors, Cyprus Medical Association, Physicians of Turin, Italy, the German Doctors Appeal, International Appeal to Stop 5G on Earth and Space, International Society of Doctors for the Environment, Officials in France, 600 Municipalities in Italy, 150 Doctors in Chile, and the Alliance of Nurses for Healthy Environments.

In the United States, the New Hampshire Commission to Study the Environmental and Health Effects of Evolving 5G Technology has released its final report recommending reducing public exposure to radio frequency radiation, measuring RF radiation levels and replacing Wi-Fi with wireless devices.

Resolutions to halt 5G have been passed by Hawaii County, Farragut Tennessee, Coconut Creek Florida, and Easton Connecticut. Cities such as Los Altos,Petaluma, Mill Valley, and San Diego County California have adopted policies to restrict 5G small cells near homes. Oregon passed a Bill to study Wi-Fi health effects.

In addition, 5G poses 2 distinct environmental challenges for Bermuda: the physical construction of four to fives times more antennas necessitated by 5G requires expanding transmitting antennas into fragile ecosystems; exposures to radiofrequency radiation (RFR) (and quadrupling of energy demand for each new antenna) will increase with the expansion of active antennas that rely on up to 128 simultaneously operating, beam-forming antennas, in contrast to traditional passive metal conductors in existing antennas. These will be operated in *addition to-not* as a replacement of- the current wireless networks. New 4G antennas are being erected as part of the "path to" 5G and thus 5*G networks include new 5G antennas as well as the densification of 4G antennas.*

The following is a sampling of countries with cell tower network radiofrequency radiation (RF) limits (maximum permissible limits) far stringent than ICNIRP and FCC limits: Belarus, Bulgaria, China, Russia, Belgium, Chile, Greece, India, Israel, Italy, Liechtenstein and Switzerland[1][2][3][4][5].

In 2011 the Parliamentary Assembly of the Council of Europe issued Resolution 1815: "The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment.[6][7]" A call to European governments to "take all reasonable measures" to reduce exposure to electromagnetic fields "particularly the exposure to children and young people who seem to be most at risk from head tumours." Resolution 1815 specifically states that governments "reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA [as low as reasonably achievable], covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation."

While many European countries have stronger limits based on their framework of precaution, countries such as India, China and Russia have much lower limits than ICNIRP and are

[1] https://apps.who.int/gho/data/node.main.EMFLIMITSPUBLICRADIOFREQUENCY?lang=en
[2] Wu T, Rappaport TS, Collins CM. Safe for Generations to Come. *IEEE Microw Mag*. 2015;16(2):65-84. doi:10.1109/MMM.2014.2377587
[3] China Rationale for Setting EMF Exposure Standards* Prof. Dr. Huai Chiang as referenced by Wu 2015
[4] Comparison of international policies on electromagnetic fields (power frequency and radiofrequency fields), Rianne Stam, National Institute for Public Health and the Environment
[5] Mary Redmayne (2016) International policy and advisory response regarding children's exposure to radio frequency electromagnetic fields (RF-EMF)Electromagnetic Biology and Medicine, 35:2, 176-185, DOI: 10.3109/15368378.2015.1038832
[6] Committee on the Environment, Agriculture and Local and Regional Affairs, Resolution 1815: "The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment," Doc. 12608, May 6, 2011, https://pace.coe.int/en/files/13137/html.

[7] Parliamentary Assembly of the Council of Europe, Resolution 1815 Final Version, May 27, 2011, http://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=17994&.

considered "science based[8]." Their limits are more stringent because their scientists completed research indicating adverse health effects at nonthermal levels of exposure. According to Russian radiation experts who have studied microwaves for decades, the following health hazards are likely to be faced in the near future by children who regularly use mobile phones: disruption of memory, decline in attention, diminished learning and cognitive abilities, increased irritability, sleep problems, increase in sensitivity to stress, and increased epileptic readiness. For these reasons, special recommendations on child safety from mobile phones have been incorporated into the current Russian mobile phone standard."[9] China's cell tower limits are based on science showing effects which include behavioral, neurological, reproductive abnormalities, and DNA damage[10].

In 2012, India's National Ministry of the Environment and Forest issued a report on the potential impacts of communication towers on wildlife with a focus on birds and bees, citing hundreds of research studies that found adverse effects. Recommendations from the Ministry include, "Introduce a law for protection of urban flora and fauna from emerging threats like ERM/EMF as conservation issues in urban areas are different from forested or wildlife habitats."[11] This research was published in the journal Biology and Medicine concluding "that out of the 919 research papers collected on birds, bees, plants, other animals, and humans, 593 showed impacts, 180 showed no impacts, and 196 were inconclusive studies." As a result of this research, the government tightened their allowable levels of radiofrequency radiation to 1/10 th of ICNIRP limits[12].

We note that these more stringent limits of some countries still do not assure safety as harm has been found at levels even lower than 1/1000th of FCC/ ICNIRP limits[13]. Until adequate exposure limits are developed based on biological effects, the recommended course of action is to decrease environmental exposure as much as possible and support wired technology in order to decrease the need for additional wireless infrastructure.

FCC limits do not protect birds, animals nor trees.

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[8] Wu T, Rappaport TS, Collins CM. Safe for Generations to Come. *IEEE Microw Mag*. 2015;16(2):65-84. doi:10.1109/MMM.2014.2377587

[9] Scientific basis for the Soviet and Russian radiofrequency standards for the general public

[10] Prof. Dr. Huai Chiang. Rationale for Setting EMF Exposure Standards. Accessed July 8, 2020.

[11] Expert Committee, Ministry of Environment and Forest, Government of India, Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees, Constituted on 30th August, 2010.

[12] S. Sivani and D. Sudarsanam, "Impacts of Radio-Frequency Electromagnetic Field (RF-EMF) from Cell Phone Towers and Wireless Devices on Biosystem and Ecosystem – A Review," *Biology and Medicine* 4, no.4 (January 2013), https://www.biolmedonline.com/Articles/Vol4_4_2012/Vol4_4_202-216_BM-8.pdf.

[13] Reported Biological Effects from Radiofrequency Radiation at Low-Intensity Exposure(Cell Tower, Wi-Fi, Wireless Laptop and 'Smart' Meter RF Intensities) The Bioinitiative Report https://bioinitiative.org/rf-color-charts/

As part of this letter, we refer you to the July 8, 2020 letter sent to EHT Director Theodora Scarato by the Environmental Protection Agency's Director of the Radiation Protection Division and Office of Radiation and Indoor Air, Lee Ann B. Veal, that confirms that the EPA has never reviewed the impact of microwave radiation on birds, bees, or trees[14]. Nor has any U.S. federal health agency ever set safety limits for trees, birds, or bees or the physical environment. No agency in the United States nor internationally has a funded mandate to ensure flora and fauna are safe from cell tower radiation. In other words, it is a gaping hole in federal accountability worldwide. ICNIRP members criticise the science finding health effects but is unable to provide adequate documentation of safety.

The U.S. Department of the Interior sent a letter in 2014[15] reviewing several research studies showing harm to birds and concluding that "The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today."

A now-retired U.S. Fish and Wildlife Service wildlife biologist, the former lead on telecommunications impacts, Dr. Albert Manville, has written to the FCC on impacts to birds and on higher frequencies to be used in 5G. Dr. Manville authored numerous publications detailing research showing harm to birds.[16,17,18]"The race to implement 5G and the push by FCC to approve the related 5G license frequencies to industry are very troubling and downright dangerous."

As stated by governmental experts on wildlife in the U.S. Department of Agriculture, Fish and Wildlife Service, FCC limits protect neither wildlife nor the natural environment. Until safety limits have been developed for flora and fauna, radiofrequency radiation exposures should be reduced to lowest feasible levels and the moratorium on 5G should be maintained.

Statements that nonionizing radiation cannot cause harm at levels that do not induce heat are out of step with the latest science.

A recent report on peer reviewed published science on impacts to insects found that 72 of 83 peer reviewed published studies found effects. Please see the report Biological effects of electromagnetic fields on insects by Alain Thill here. Research has found that nonthermal levels of RFR can have damaging environmental impacts including: damage to plants and trees from

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[14] July 8, 2020, Lee Ann B. Veal Director, Radiation Protection Division Office of Radiation and Indoor Air, Environmental Protection Agency

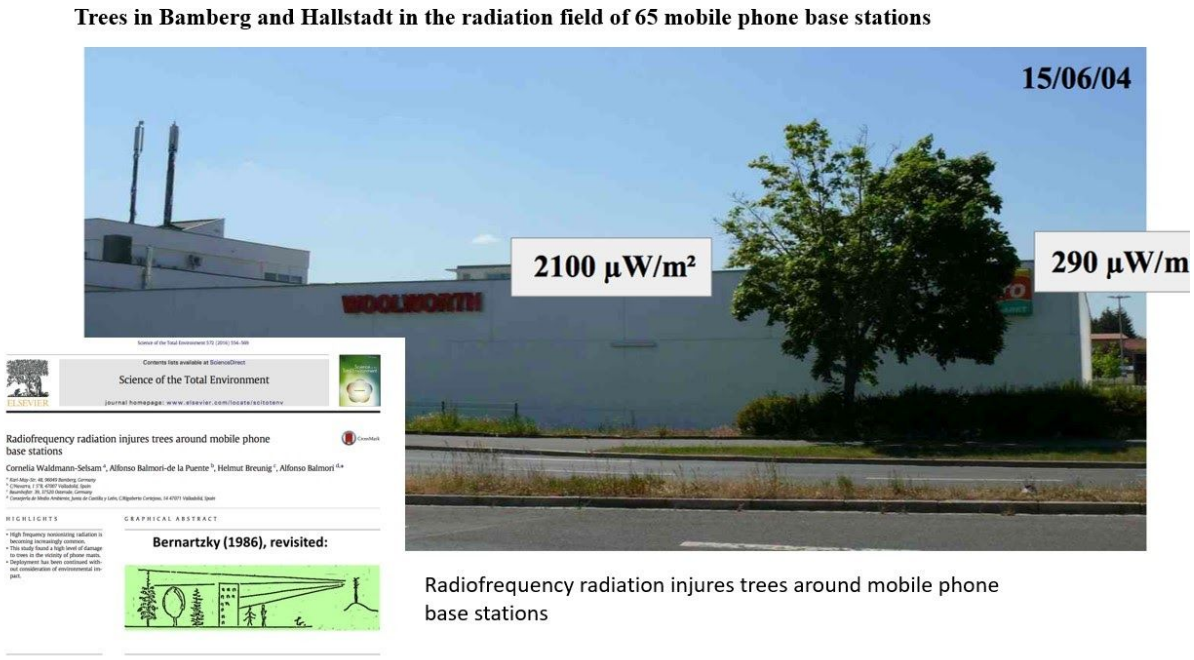
[15] Washington DC, Veenendaal ME. Department of Interior Letter. *United States Department of the Interior OFFICE OF THE SECRETARY.*

[16] ECFS Filing Detail. https://www.fcc.gov/ecfs/filing/1060315601199. Accessed July 8, 2020.

[17] Albert M. Manville Ph.D. Former U.S. Fish and Wildlife Service Senior Biologist. Memorandum on the Bird and Wildlife Impacts of Non-ionizing Radiation. Environmental Health Trust. Accessed July 8, 2020.

[18] Manville AM. *Collisions, Electrocutions, and Next Steps-Manville BIRD STRIKES AND ELECTROCUTIONS AT POWER LINES, COMMUNICATION TOWERS, AND WIND TURBINES: STATE OF THE ART AND STATE OF THE SCIENCE B NEXT STEPS TOWARD MITIGATION 1.*; 2002.

operating cell antennas (Waldmann Selsam 2016, Helmut 2016, Haggerty 2010, Halgamuge 2017, Pall 2016, Halgamuge and Davis 2019); impairment of action in honeybees (and other pollinators) such as inducing artificial worker piping (Favre, 2011), disrupting navigation abilities (Goldsworthy, 2009; Sainudeen, 2011; Kimmel et al., 2007) decreasing rate egg laying rate and reducing colony strength (Sharma and Kumar, 2010 ; Harst et al., 2006); and impacts to birds (Schwarze 2016, Engels et al., 2014, Balmori 2009, Balmori 2015, Manville 2009, Wiltschko 2015, Kavokin 2014, Tsybulin 2013, Everaert 2007, Broomhall 2015).



Radiofrequency radiation injures trees around mobile phone base stations

FCC limits do not protect the rapidly developing brains, immune systems, and reproductive organs of young children.

Without scientific corroboration, the FCC asserts that its 20th century limits originally set when major users of phones were medical and military users, can also be invoked to protect children's developing brain and body. The reality is that they do not. As the American Academy of Pediatrics and other exists have noted, young children, and especially fetuses, are more vulnerable than adults for most environmental exposures (Sly and Carpenter, 2012). This is because their cells are rapidly dividing and their organ systems are not mature. There is a growing body of experimental and epidemiological evidence indicating that exposure to RF-EMFs has adverse effects on cognition and neurobehavior, especially in children and adolescents. Adverse effects during development can have life-long consequences and children will receive a greater cumulative exposure than adults (Belpomme et. al, 2018).

Research on animals (Bas et al., 2009; Deshmukh et al., 2015; Shahin et al., 2017;Megha et al., 2015;Aldad et al., 2012; Zhang et al., 2015) shows impacts from RFR to the brain such as alterations in neurodevelopment and behavior of offspring, impaired learning and spatial memory, a deleterious impact on hippocampal, pyramidal or cortical neurons and induced markers of oxidative stress and inflammation in the brain. Human data is consistent with these animal studies as they have found higher cell phone radiation associated with behavioral problems and memory damage (Divan et al., 2012; Birks et al. 2017; Foerster et. al., 2018).

FCC limits do not protect babies nor the developing baby

Pregnancy is a time of the highest vulnerability as the fetal skull is thin and environmental impacts during early development can have long lasting effects later in life. Studies on pregnant women who used cell phones more heavily have been found to have newborns with biochemical changes to their blood, impaired fetal growth. Yale animal studies linked prenatal cellphone radiation exposure to damaged memory and hyperactivity. Although more research still needs to be done, replicated studies of thousands of children and pregnant women found increased behavioral problems associated with cell phone exposure which led to Yale doctors recommending that children reduce cell phone and wireless radiation exposure. See BabySafe Project , PDF of Brochure, EHHI Cell Phones: Technology, Exposures, Health Effects

FCC limits were not developed with an understanding of synergistic effects.
Research has found that EMF exposure can act synergistically with other environmental pollutants. Prenatal (Choi et al., 2017) and postnatal (Byun et al., 2017) mobile phone exposure has been found to result in greater neurobehavioral effects in children with elevated lead levels than those seen with elevated lead alone. These results indicate that EMFs can act synergistically with other environmental contaminants known to cause a reduction in intelligence quotient (IQ).

Replicated results from animal studies show co-carcinogenic and tumor promoting effects from RF-EMF when RF is combined with a known carcinogen (Tillmann et al., 2010; Lerchl et al., 2015). The studies used a very low level of radiofrequency radiation, far lower than FCC SAR limits for cell phones, yet found increases in tumors from the combined exposures.

FCC limits do not protect from biological effects.

Most importantly, FCC limits are based on protection from thermal (heating) effects despite a large body of evidence that has found non thermal effects (Bandara 2018, Clegg 2020, Miller 2019, Miller 2018 , Kostoff 2013, Yakymenko 2016, Pall 2013, Smith Roe 2020, Houston 2016).

We have attached additional extensive documentation on the scientific evidence indicating serious health hand environmental impacts from 5G and small cell densification.

Global Secondary Insurance Firms Classify 5G as High Risk

A 2019 Report by Swiss Re Institute[19] classifies 5G mobile networks as an "off-the-leash" risk, meaning a high-impact emerging risk that will affect property and casualty claims in more than three years' time.

The report states:

- "Existing concerns regarding potential negative health effects from electromagnetic fields (EMF) are only likely to increase. An uptick in liability claims could be a potential long-term consequence."
- "As the biological effects of EMF in general and 5G in particular are still being debated, potential claims for health impairments may come with a long latency."

Consultation Question: Do you agree that the 5G Moratorium should be removed? If not, should it be modified and how should it be modified and why?

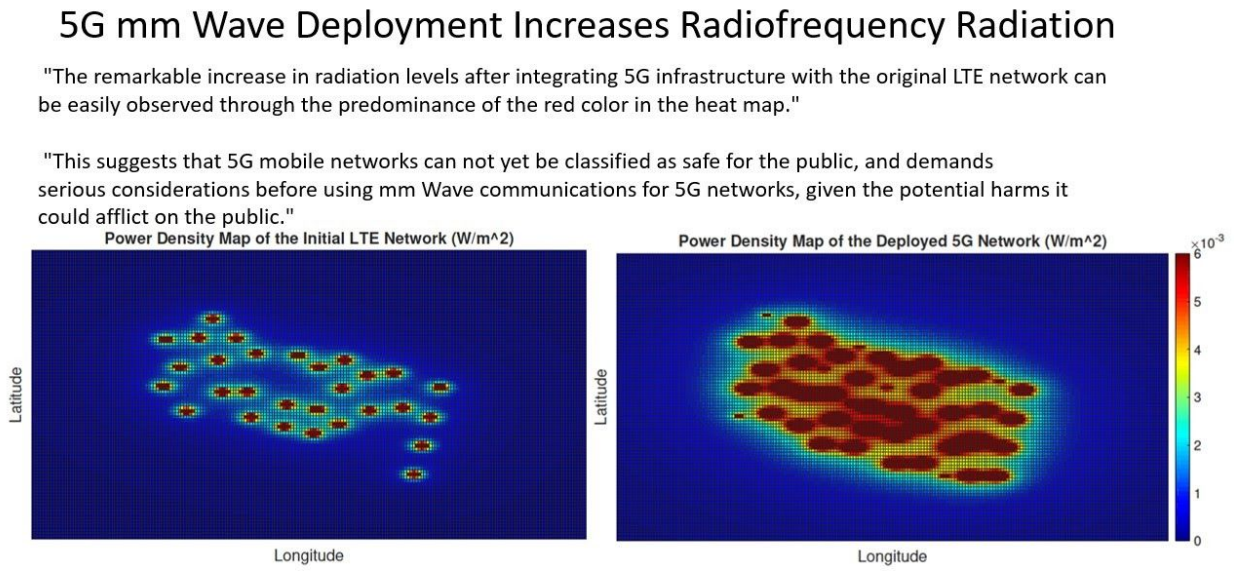
Answer: The Moratorium should remain in place until adequate data demonstrating safety is provided. We have joined with over 400 scientists calling to halt 5G in the 5G Appeal. The current weight of scientific evidence refutes the prominent claim that the deployment of wireless technologies poses no health risks (Bandara and Carpenter, 2018). Evidence supports the International EMF Scientist Appeal by 244 scientists from 41 countries who have published on the subject in peer-reviewed literature and collectively petitioned the WHO and the UN for immediate measures to reduce public exposure to artificial electromagnetic fields and radiation.

Consultation Question: Should mmWave networks and small-cell technologies be restricted or prohibited in Bermuda? If so, why and what alternatives should be used?

Answer: No new frequencies should be deployed until proper testing for long term safety has been completed. The safe alternative is to use wired connectivity for most telecommunications and technology needs. This will reduce the need to increase capacity. We recommend a public awareness program for Bermuda to educate residents and visitors on how to reduce exposures to radiofrequency radiation. Several countries like Cyprus, French Polynesia and France have large scale public education programs informing residents about the radiation and how to reduce exposure.

[19] Swiss Re Institute, New Emerging Risk Insights, 2019

A 2020 paper "Radiation Analysis in a Gradual 5G Network Deployment Strategy," presented at the IEEE 3rd 5G World Forum documents how engineers found significant increases in levels of radio frequency radiation would result if a mmWave-based 5G network was fully deployed in Austin Texas. The researchers first mapped the pre-existing LTE antennas and then laid out the real world design for the densification of cell towers and signal repeaters which would be needed in the City in order to fully build out a mmWave-based 5G network. The engineers then simulated the RF power densities that would be experienced in the outdoor environments should the 5G mmWave antennas be installed. They found the fully deployed 5G mmWave network would result in significant increases in outdoor RF levels for the City. The researchers conclude that, "This suggests that 5G mobile networks can not yet be classified as safe for the public, and demands serious considerations before using mmWave communications for 5G networks, given the potential harms it could afflict on the public." The engineers created a heat map to show the increased radiation levels should 5G be fully deployed in Austin Texas.



A. M. EL-HAJJ AND T. NAOUS, "RADIATION ANALYSIS IN A GRADUAL 5G NETWORK DEPLOYMENT STRATEGY," *2020 IEEE 3RD 5G WORLD FORUM (5GWF)*

Documented Impacts to Wildlife and the Environment

The U.S. Department of the Interior sent a letter in 2014[20] reviewing several research studies showing harm to birds and concluding that "The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today."

A now-retired U.S. Fish and Wildlife Service wildlife biologist, the former lead on telecommunications impacts, Dr. Albert Manville, has written to the FCC on impacts to birds

[20] Washington DC, Veenendaal ME. Department of Interior Letter. *United States Department of the Interior OFFICE OF THE SECRETARY.*

and on higher frequencies to be used in 5G. Dr. Manville authored numerous publications detailing research showing harm to birds.[21,22,23]"The race to implement 5G and the push by FCC to approve the related 5G license frequencies to industry are very troubling and downright dangerous."

- "A review of the ecological effects of RF-EMF" reviewed 113 studies finding RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms, and plants in 70% of the studies (Cucurachi 2013). Development and reproduction in birds and insects were the most strongly affected. As an example of the several studies on wildlife impacts, a study focusing on RF from antennas found increased sperm abnormalities in mice exposed to RF from GSM antennas (Otitoloju 2010).
- "Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz" published in Scientific Reports is the first study to investigate how insects (including the Western honeybee) absorb the higher frequencies (2 GHz to 120 GHz) to be used in the 4G/5G rollout. The scientific simulations showed increases in absorbed power between 3% to 370% when the insects were exposed to the frequencies. Researchers concluded, "This could lead to changes in insect behaviour, physiology, and morphology over time…."
- Studies on bees have found behavioral effects (Kumar 2011, Favre 2011), disrupted navigation (Goldsworthy 2009, Sainudeen 2011, Kimmel et al. 2007), decreasing egg laying rate (Sharma and Kumar, 2010), and reduced colony strength (Sharma and Kumar, 2010, Harst et al. 2006).
- Research has also found a high level of damage to trees from antenna radiation. For example, a field monitoring study spanning 9 years involving over 100 trees (Waldmann-Selsam 2016) found trees sustained more damage on the side of the tree facing the antenna.
- A study on Aspen trees near Lyons, Colorado entitled "Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings" published in the *International Journal of Forestry* found adverse effects on growth rate and fall anthocyanin production, concluding that "results of this preliminary experiment indicate that the RF background may be adversely affecting leaf and shoot growth and inhibiting fall production of anthocyanins associated with leaf senescence in Trembling Aspen seedlings. These effects suggest that exposure to the RF background may be an underlying factor in the recent rapid decline of Aspen populations. Further studies are underway to test this hypothesis in a more rigorous way."[24]

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[21] ECFS Filing Detail. https://www.fcc.gov/ecfs/filing/1060315601199. Accessed July 8, 2020.
[22] Albert M. Manville Ph.D. Former U.S. Fish and Wildlife Service Senior Biologist. Memorandum on the Bird and Wildlife Impacts of Non-ionizing Radiation. Environmental Health Trust. Accessed July 8, 2020.
[23] Manville AM. *Collisions, Electrocutions, and Next Steps-Manville BIRD STRIKES AND ELECTROCUTIONS AT POWER LINES, COMMUNICATION TOWERS, AND WIND TURBINES: STATE OF THE ART AND STATE OF THE SCIENCE B NEXT STEPS TOWARD MITIGATION 1.*; 2002.
[24] Katie Haggerty, "Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings: Preliminary Observations," *International Journal of Forestry Research*, vol. 2010, Article ID 836278, 7 pages, 2010. doi.org/10.1155/2010/836278.

- An analysis of 45 peer-reviewed scientific publications (1996–2016) on changes in plants due to the non-thermal RF-EMF effects from mobile phone radiation entitled "Weak radiofrequency radiation exposure from mobile phone radiation on plants" concludes, "Our analysis demonstrates that the data from a substantial amount of the studies on RF-EMFs from mobile phones show physiological and/or morphological effects (89.9%, $p < 0.001$). Additionally, our analysis of the results from these reported studies demonstrates that the maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbean plants seem to be very sensitive to RF-EMFs. Our findings also suggest that plants seem to be more responsive to certain frequencies…."[25]

Electromagnetic Fields Can Alter Animal and Insect Orientation

Science of the Total Environment published environmental scientist Alforso Balmori's "Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation," which states, "Current evidence indicates that exposure at levels that are found in the environment (in urban areas and near base stations) may particularly alter the receptor organs to orient in the magnetic field of the earth. These results could have important implications for migratory birds and insects, especially in urban areas, but could also apply to birds and insects in natural and protected areas where there are powerful base station emitters of radio frequencies. Therefore, more research on the effects of electromagnetic radiation in nature is needed to investigate this emerging threat."[26]

Multiple research studies have documented how animals' magnetoreception can be disrupted by external electromagnetic fields, from mice[27] to cows to dogs to birds.[28] Electromagnetic exposure is especially disruptive to migratory birds.[29] Electromagnetic fields have been shown to disrupt the magnetic compass orientation used by birds to navigate.[30,31] Researchers have suggested this disruption of magnetoreception is due to cryptochrome photoreceptors that allow birds to use built-in receptors as a biological compass.

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[25] Malka N. Halgamuge (2017) Review: Weak radiofrequency radiation exposure from mobile phone radiation on plants, *Electromagnetic Biology and Medicine*, 36:2, 213-235, DOI: 10.1080/15368378.2016.1220389.
[26] Alfonso Balmori, Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation, *Science of The Total Environment*, Volumes 518–519, 2015, Pages 58-60, ISSN 0048-9697, doi.org/10.1016/j.scitotenv.2015.02.077.
[27] Malkemper, E.P., et al. "Magnetoreception in the wood mouse (Apodemus sylvaticus): influence of weak frequency-modulated radio frequency fields." *Scientific Reports*, vol. 4, no. 9917, 2015.
[28] Wiltschko Roswitha, Thalau Peter, Gehring Dennis, Nießner Christine, Ritz Thorsten, Wiltschko Wolfgang. Magnetoreception in birds: the effect of radio-frequency fields.12. *Journal of The Royal Society Interface*.
[29] Engels, Svenja, et al. "Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird." *Nature* 509.7500 (2014): 353-356.
[30] Wiltschko, Roswitha, et al. "Magnetoreception in birds: the effect of radio-frequency fields." *Journal of The Royal Society Interface* 12.103 (2015): 20141103.
[31] Schwarze, S., et al. "Weak Broadband Electromagnetic Fields are More Disruptive to Magnetic Compass Orientation in a Night-Migratory Songbird (Erithacus rubecula) than Strong Narrow-Band Fields." *Front Behav Neurosci*. 10.55 (2016).

In 2012, the government of India's Ministry of the Environment and Forest issued a report on the potential impacts of communication towers on wildlife, citing hundreds of research studies that found adverse effects. Recommendations from the Ministry include, "Introduce a law for protection of urban flora and fauna from emerging threats like ERM/EMF as conservation issues in urban areas are different from forested or wildlife habitats."[32]

A 2017 report to UNESCO[33] by botanist Mark Broomhall details the association between increasing amounts of electromagnetic radiation from cellular antennas on the Mt. Nardi tower complex and species disappearance and exodus from the Mt. Nardi area of the Nightcap National Park World Heritage Area during a 15-year period (2000–2015). He estimates "in both volume and species that from 70 to 90% of the wildlife has become rare or has disappeared from the Nightcap National Park within a radius of the Mt. Nardi tower complex. This statement can be summarised with concrete data: 3 bat species once common have become rare or gone, 11 threatened and endangered bird species are gone, 11 migratory bird species are gone, 86 bird species are demonstrating unnatural behaviours, 66 once common bird species are now rare or gone." The Report concludes, "With these short explanations of events we can appreciate that the effects of this technology and its application on Mt. Nardi over the last fifteen years, affect not only the top of the life chain species but they are devastating the fabric of the continuity of the World Heritage, causing genetic deterioration in an insidious, massive and ever escalating scale. To truly understand what these studies reveal is to stare into the abyss."

It is very important that in considering antenna placement, there be a full environmental assessment on migratory animal patterns (from the smallest to the largest) and not simply on birds and mammals like the pronghorn but also on impacts to amphibians and insects.

Wireless Radiation is Known to Harm Humans and Wildlife

Human health effects include impaired reproduction, increased incidence of brain cancer, DNA breaks, oxidative stress, immune dysfunction, altered brain development, sleep changes, hyperactivity, and memory and cognitive problems.[34] Since the WHO/IARC classified EMF as a Group 2B Possible Carcinogen in 2011, the peer-reviewed research connecting wireless exposure to cancer has significantly strengthened and several scientists have published documentation that

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[32] Expert Committee, Ministry of Environment and Forest, Government of India, Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees, Constituted on 30th August, 2010.

[33] Broomhall, Mark. "Report detailing the exodus of species from the Mt. Nardi area of the Nightcap National Park World Heritage Area during a 15-year period (2000-2015.)" United Nations Scientific and Cultural Organization (2017).

[34] For more information on acute health symptoms, see, e.g., Martin Pall, Microwave Frequency Electromagnetic Fields (EMFs) Produce Widespread Neuropsychiatric Effects Including Depression, 75 *J. Chemical Neuroanatomy* 43-51 (Sept. 2016); Response of residents living in the vicinity of a cellular phone base station in France ; Electromagnetic Fields: A Hazard to Your Health?, Healthy Children.

the weight of current peer-reviewed evidence supports the conclusion that radiofrequency radiation should be regarded as a human carcinogen.[35,36,37]

- The 10-year $30 million National Institute of Environmental Health Sciences National Toxicology Program's (NTP) "Studies of the Toxicology and Carcinogenicity of Cell Phone Radiation"[38,39] found that RFR was associated with "clear evidence" of cancer due to the increased malignant schwannomas found in RFR-exposed male rats. The brain (glioma) cancers and tumors in the adrenal glands were also considered evidence of an association with cancer. In addition, exposed animals had significantly more DNA damage, heart damage, and low birth weight.
- The Ramazzini Institute published its findings[40] that animals exposed to very low-level RFR developed the same types of cancers as reported by the NTP.
- Long-term research on humans who have used cell phones has found increased tumors—schwannomas and glioblastomas—the same cell type as found in the NTP and Ramazzini Institute studies. Persons who started using cell phones under age 20 had the highest risk.[41]
- A 2015 Jacobs University study (replicating a 2010 study) found that weak cell phone signals significantly promote the growth of tumors in mice and that combining a toxic chemical exposure with RF more than doubled the tumor response.[42,43]
- "5G wireless telecommunications expansion: Public health and environmental implications," is a research review published in *Environmental Research*, which documents the range of adverse effects reported in the published literature, from cancer to bacteria growth changes to DNA damage, concludes that "a moratorium on the deployment of 5G is warranted" and "the addition of this added high-frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome both from both physical and mental health perspectives."[44]

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[35] Adams, Jessica A., et al. "Effect of mobile telephones on sperm quality: a systematic review and meta-analysis." *Environment International,* 70, 2014, pp. 106-112.
[36] Deshmukh, P.S., et al. "Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation." *International Journal of Toxicology*, vol. 34, no. 3, 2015, pp. 284-90.
[37] Aldad, T.S., et al. "Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice." *Scientific Reports,* vol. 2, no. 312, 2012.
[38] National Toxicology Program, Cell Phone Radio Frequency Radiation
[39] High exposure to radio frequency radiation associated with cancer in male rats
[40] L. Falcioni, L. Bua, E. Tibaldi, M. Lauriola, L. De Angelis, F. Gnudi, D. Mandrioli, M. Manservigi, F. Manservisi, I. Manzoli, I. Menghetti, R. Montella, S. Panzacchi, D. Sgargi, V. Strollo, A. Vornoli, F. Belpoggi, Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission, *Environmental Research*, Volume 165, 2018, Pages 496-503, ISSN 0013-9351, doi.org/10.1016/j.envres.2018.01.037.
[41] https://www.pathophysiologyjournal.com/article/S0928-4680(14)00064-9/fulltext
[42] Lerchl, Alexander, et al. "Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans." *Biochemical and Biophysical Research Communications,* vol. 459, no. 4, 2015, pp. 585-90.
[43] Tillmann, Thomas, et al. "Indication of cocarcinogenic potential of chronic UMTS-modulated radiofrequency exposure in an ethylnitrosourea mouse model." *International Journal of Radiation Biology,* vol. 86, no. 7, 2010, pp. 529-41.
[44] https://doi.org/10.1016/j.envres.2018.01.016

- A study published in Electromagnetic Biology and Medicine, "Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base station," compared people living close and far from cell antennas and found that people living closer to cell antennas had higher radiation levels in the homes and several significant changes in their blood predictive of cancer development."[45]
- A 2019 study of students in schools near cell towers found their higher RF exposure was associated with impacts on motor skills, memory, and attention (Meo 2019).[46] Examples of other effects linked to cell towers in research studies include neuropsychiatric problems,[47] elevated diabetes,[48] headaches,[49] sleep problems,[50] and genetic damage.[51] Such research continues to accumulate after the 2010 landmark review study on 56 studies that reported biological effects found at very low intensities of wireless radiation, including impacts on reproduction, permeability of the blood-brain barrier, behavior, cellular changes, and metabolic changes, and increases in cancer risk (Lai and Levitt 2010).[52]
- Published research has found impacts from wireless radiation exposure to reproduction and brain development in addition to a myriad of other adverse effects.[53,54,55,56] Although renowned institutions, such as the Cleveland Clinic, advise men to keep phones and

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[45] Zothansiama & Zosangzuali, Mary & Lalramdinpuii, Miriam & Jagetia, Ganesh & Siama, Zothan. (2017). Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations. Electromagnetic Biology and Medicine. 36. 1-11. 10.1080/15368378.2017.1350584.

[46] Meo, S. A., Almahmoud, M., Alsultan, Q., Alotaibi, N., Alnajashi, I., & Hajjar, W. M. (2019). Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health. *American Journal of Men's Health*. doi.org/10.1177/1557988318816914.

[47] G. Abdel-Rassoul, O. Abou El-Fateh, M. Abou Salem, A. Michael, F. Farahat, M. El-Batanouny, E. Salem, Neurobehavioral effects among inhabitants around mobile phone base stations, NeuroToxicology, Volume 28, Issue 2, 2007, Pages 434-440, ISSN 0161-813X, doi.org/10.1016/j.neuro.2006.07.012.

[48] SA, Meo & Alsubaie, Yazeed & Almubarak, Zaid & Almutawa, Hisham & AlQasem, Yazeed & Hasanato, Rana. (2015). Association of Exposure to Radio-Frequency Electromagnetic Field Radiation (RF-EMFR) Generated by Mobile Phone Base Stations with Glycated Hemoglobin (HbA1c) and Risk of Type 2 Diabetes Mellitus. International Journal of Environmental Research and Public Health. 12. 14519-14528;. 10.3390/ijerph121114519.

[49] Hutter, H. P., Moshammer, H., Wallner, P., & Kundi, M. (2006). Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. *Occupational and environmental medicine*, *63*(5), 307–313. doi:10.1136/oem.2005.020784.

[50] R. Santini, P. Santini, J.M. Danze, P. Le Ruz, M. Seigne, Enquête sur la santé de riverains de stations relais de téléphonie mobile: I/Incidences de la distance et du sexe, Pathologie Biologie, Volume 50, Issue 6, 2002, Pages 369-373, ISSN 0369-8114, doi.org/10.1016/S0369-8114(02)00311-5.

[51] Gursatej Gandhi, Gurpreet Kaur & Uzma Nisar (2015) A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station, Electromagnetic Biology and Medicine, 34:4,344-354, DOI: 10.3109/15368378.2014.933349.

[52] B. Blake Levitt and Henry Lai, Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays, Environ. Rev. Downloaded from www.nrcresearchpress.com by 172.58.41.200 on 04/10/19

[53] Adams, Jessica A., et al. "Effect of mobile telephones on sperm quality: a systematic review and meta-analysis." *Environment International,* 70, 2014, pp. 106-112.

[54] Deshmukh, P.S., et al. "Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation." *International Journal of Toxicology*, vol. 34, no. 3, 2015, pp. 284-90.

[55] Aldad, T.S., et al. "Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice." *Scientific Reports,* vol. 2, no. 312, 2012.

[56] Sonmez, O.F., et al. "Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field." *Brain Research,* vol. 1356, 2010, pp. 95-101.

wireless devices away from their reproductive organs, the public remains largely unaware.

Once the towers are erected, they will be upgraded over time with new antennas and soon 5G technology. 5G would use today's wireless frequencies while adding new, higher frequencies to transmit data at faster speeds. These higher frequency millimeter waves uniquely penetrate the eyes and skin,[57,20,21,22] and have been shown to accelerate bacterial and viral cell growth.[58] Millimeter waves were originally developed as a military weapon to create the sensation that the skin is burning.[59] Currently accepted standards are not sophisticated enough to measure effects on sweat glands or quantify the risks of cumulative exposure.[60,61]Any future applications of these technologies must consider the biological effect of cumulative exposures to these frequencies.

Radiofrequency radiation exposure is increasing at a rapid pace.

A 2018 article published in *The Lancet Planetary Health* points to unprecedented increasing RF exposures, and the abstract concludes, "due to the exponential increase in the use of wireless personal communication devices (eg, mobile or cordless phones and WiFi or Bluetooth-enabled devices) and the infrastructure facilitating them, levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 1018 times…"(Bandara and Carpenter, 2018).[62]

Another key finding from Zothansiama 2017 was that homes closer to antennas had measurably higher radiation levels—adding to the documentation that antennas increase RF levels. An Australian study also found that children in kindergartens with nearby antenna installations had nearly three-and-a-half times higher RF exposures than children with installations further away (more than 300 meters) (Bhatt 2016).[63]

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[57] A lecture by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the 2017 IIAS Conference website. Feldman, Yuri and Paul Ben-Ishai. "Potential Risks to Human Health Originating from Future Sub-MM Communication Systems." *Conference on Wireless and Health*, 2017.

[58] Cindy L. Russell, 5G Wireless Telecommunications Expansion: Public Health and Environmental Implications, 165 Envt'l Res. 484 (2018).

[59] For information on Active Denial Systems, see, e.g., Vehicle-Mounted Active Denial System (V-MADS) ; Active Denial System FAQs.

[60] A lecture by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the 2017 IIAS Conference website. Feldman, Yuri and Paul Ben-Ishai. "Potential Risks to Human Health Originating from Future Sub-MM Communication Systems." *Conference on Wireless and Health*, 2017.

[61] Hayut, Itai, Paul Ben Ishai, Aharon J. Agranat and Yuri Feldman. "Circular polarization induced by the three-dimensional chiral structure of human sweat ducts." *Physical Review E*, vol. 89, no. 042715, 2014.

[62] Priyanka Bandara, David O Carpenter, Planetary electromagnetic pollution: it is time to assess its impact, *The Lancet Planetary Health*, Volume 2, Issue 12, 2018, Pages e512-e514,ISSN 2542-5196, doi.org/10.1016/S2542-5196(18)30221-3.

[63] Bhatt, C. R., Redmayne, M., Billah, B., Abramson, M. J., & Benke, G. (2016). Radiofrequency-electromagnetic field exposures in kindergarten children. *Journal Of Exposure Science And Environmental Epidemiology*, *27*, 497. Retrieved from https://doi.org/10.1038/jes.2016.55.

A 2018 multi-country study that measured RF in several countries found that cell phone network tower radiation is the dominant contributor to RF exposure in most outdoor areas, exposure in urban areas was higher, and that exposure has drastically increased. As an example, the measurements the researchers took in Los Angeles, USA was 70 times higher than the US EPA estimate 40 years ago.[64]

Telecommunications Companies Warn Their Shareholders

In fact, a number of corporations already advise their shareholders that they could face serious financial risks from the health damages due to RF. For instance, Crown Castle's 2019 10-K ANNUAL REPORT states that,

> If radio frequency emissions from wireless handsets or equipment on our communications infrastructure are demonstrated to cause negative health effects, potential future claims could adversely affect our operations, costs or revenues.
> The potential connection between radio frequency emissions and certain negative health effects, including some forms of cancer, has been the subject of substantial study by the scientific community in recent years. We cannot guarantee that claims relating to radio frequency emissions will not arise in the future or that the results of such studies will not be adverse to us.
> If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters.

Most wireless companies, from AT&T to Nokia to T Mobile to Verizon Wireless, have issued similar warnings to their shareholders. Why are shareholders being warned but not the people living near the equipment? These disclosures show that even corporations cannot assure safety.

Due to these evaluations and the published scientific evidence, cell phone manufacturers cannot insure against health damages from the radiofrequency radiation emitted by their products and networks. In fact, most insurance plans do not cover electromagnetic fields (EMF) and have very clear "electromagnetic field exclusions." In order for insurance companies to cover EMF, one often must purchase additional "Pollution Liability" or "Policy Enhancement" coverage.

According to CFC Underwriting LTD in London, the UK agent for Lloyd's:

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[64] Sanjay Sagar, Seid M. Adem, Benjamin Struchen, Sarah P. Loughran, Michael E. Brunjes, Lisa Arangua, Mohamed Aqiel Dalvie, Rodney J. Croft, Michael Jerrett, Joel M. Moskowitz, Tony Kuo, Martin Röösli, Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context, Environment International, Volume 114, 2018, Pages 297-306, ISSN 0160-4120, doi.org/10.1016/j.envint.2018.02.036.

> The Electromagnetic Fields Exclusion (Exclusion 32) is a General Insurance Exclusion and is applied across the market as standard. The purpose of the exclusion is to exclude cover for illnesses caused by continuous long-term non-ionising radiation exposure i.e. through mobile phone usage.

Even AT&T Mobile Insurance excludes loss from "pollutants," and its policy defines "Pollutants" as "Any solid, liquid, gaseous, or thermal irritant or contaminant including smoke, vapor, soot, fumes, acid, alkalis, chemicals, artificially produced electric fields, magnetic field, electromagnetic field, sound waves, microwaves, and all artificially produced ionizing or non-ionizing radiation and waste" (pg. 4) AT &T Mobile Insurance Policy, February 2014.

If insurance companies will not insure EMF, and if even telecommunications companies consider EMF as a "pollutant," how can governments allow such an environmental pollutant without also warning their citizens as companies do?

A 2018 study published in *Annals of Telecommunications* found increased RF-EMF exposure from small cell LTE networks in two urban cities in France and the Netherlands. Researchers measured the RF-EMF from LTE (Long-Term Evolution), MC (macro cells meaning large cell towers), and SC networks (low-powered small cell base stations) and found that the small cell networks increased the radio emissions from base stations (called downlink) by a factor of 7–46 while decreasing the radio emissions from user equipment exposure (called uplink) by a factor of 5–17. So while the devices themselves could emit less radiation, the cell antennas will increase the ambient environmental levels (Mazloum et al., 2019). This study shows the increased exposures would be involuntary. We can turn our phones off, but we cannot turn off the antennas in the neighborhood. The birds, bees, and trees have no choice.

Dr. Hugh Taylor, Chair of Obstetrics at Yale New Haven Medicine and John Wargo, Ph.D.,

Dr. Taylor's research on pregnant mice found the offspring had increased hyperactivity, lower memory scores and abnormal development of neurons in the part of the brain linked to ADHD. Since then he has recommended that pregnant women keep phones and wireless devices away from a pregnant women's abdomen. In his talks he states, "There's essentially no downside to being cautious and protecting your baby" and presents his research plus additional studies in 2008, 2012 inking cell phone radiation to behavior problems in children. He is a signatory to the

EPA recognised BabySafe Project now signed by hundreds of doctors, educators and scientists which lists ten ways to reduce cell phone radiation exposure.

Dr. Hugh Taylor is chief of obstetrics and gynecology at Yale New Haven Hospital and professor of obstetrics, gynecology and reproductive sciences and of molecular, cellular and development biology at Yale School of Medicine. Dr. Taylor was elected to the National Academy of Medicine, one of the nation's highest honors in the fields of health and medicine and has been funded by the National Institutes of Health continuously for more than 20 years.

- Cell phone use in pregnancy may affect offspring's brain
- BabySafe Project , PDF of Brochure

John Wargo, Ph.D., professor of Environmental Risk and Policy at Yale University and lead author of the report "Cell Phones: Technology, Exposures, Health Effects" said, "The scientific evidence is sufficiently robust showing that cellular devices pose significant health risks to children and pregnant women. The weight of the evidence supports stronger precautionary regulation by the federal government. The cellular industry should take immediate steps to reduce emission of electromagnetic radiation (EMR) from phones and avoid marketing their products to children."

California Department of Health Cell Phone Advisory

The California Department of Public Health (CDPH) Issued guidance on how to reduce exposure to radiofrequency energy from cell phones in December 2017.
"Children's brains develop through the teenage years and may be more affected by cell phone use," said Dr. Smith of the California Department of Public Health. "Parents should consider reducing the time their children use cell phones and encourage them to turn the devices off at night."

- PDF of California Guidance on Reducing Cell Phone Radiation Exposure
- CDPH Press Release December 13, 2017

Maryland State Commission on Children

In 2017, the Maryland State Children's Environmental Health And Protection Advisory Council issued advised local school districts reduce classroom wireless radiation exposures by providing wired—rather than wireless—internet connections and educating students on severa steps they can take to reduce exposure to Wi-Fi computers.

- The Maryland State Children's Environmental Health and Protection Advisory Council

The American Academy of Pediatrics

The American Academy of Pediatrics is our nations largest group of doctors dedicated to the health, safety and well-being of infants, children, adolescents, and young adults.

- PDF of AAP letters on cell phones and wireless

In 2016, the AAP issued ten cell phone safety tips specifically to reduce exposure to wireless radiation.

- "They're not toys. They have radiation that is emitted from them and the more we can keep it off the body and use (the phone) in other ways, it will be safer," said Jennifer A. Lowry, M.D., FAACT, FAAP, chair of the AAP Council on Environmental Health Executive Committee in a press release after the NTP study findings were released.

The AAP Healthy Child Web Page on Electromagnetic Fields: A Hazard to Your Health? states:

> "Cell Phones: In recent years, concern has increased about exposure to radio frequency electromagnetic radiation emitted from cell phones and phone station antennae. An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing: Headaches, Memory problems, Dizziness, Depression, Sleep problems"

Examples of the Manufacturer's Instructions

Here are some examples of the radiofrequency statement for phones as well as other wireless devices people use every day. If phones are used in positions closer than this manufacturer's stated distance, research shows the cell phone user could potentially receive excessive cell phone radiation SAR levels which violate the Federal Communications Commission (FCC) regulatory limits.

Samsung Health and Safety Information	"Body-worn operations are restricted to belt-clips, holsters or similar accessories that have no metallic component in the assembly and must provide at least 1.5cm separation between the device and the user's body."
iPhone 11 Pro Max	"During testing, iPhone radios are set to their highest transmission levels and placed in positions that simulate uses against the head, with no separation, and when worn or carried against the torso of the body, with 5mm separation."

-Nokia 8110 4G Phone (2019 Manual)	“This device meets RF exposure guidelines when used against the head or when positioned at least 5/8 inch (1.5 centimetres) away from the body. When a carry case, belt clip or other form of device holder is used for body-worn operation, it should not contain metal and should provide at least the above stated separation distance from the body.”
Safety & regulatory information (Pixel & Pixel XL 2016)	“Body worn operation: Pixel complies with radio frequency specifications when used near your ear or at a distance of 0.4 in (1.0 cm) from your body. Pixel XL complies with radio frequency specifications when used near your ear or at a distance of 0.4 in (1.0 cm) from your body. Ensure that the device accessories, such as a device case and device holster, are not composed of metal components. Keep the device away from your body to meet the distance requirement.”
Samsung 3G Laptop Manual	“Usage precautions during 3G connection : Keep safe distance from pregnant women’s stomach or from lower stomach of teenagers. Body worn operation: Important safety information regarding radiofrequency radiation (RF) exposure. To ensure compliance with RF exposure guidelines the Notebook PC must be used with a minimum of 20.8 cm antenna separation from the body.”
Owlcam Manual with RF Instructions	Caution exposure to radiofrequency radiation, to comply with FCC RF exposure compliance requirements for mobile configurations, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.”
PlayStation 3	“This equipment complies with FCC/IC radiation exposure limits set forth for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65 and RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated with at least 20 cm (8 in) and more between the radiator and person’s body (excluding extremities: hands, wrists, feet and legs).”

Amazon Echo	"Information Regarding Exposure to Radio Frequency Energy…This device should be installed and operated with a minimum distance of 20cm between the radiator and your body. The remote control meets the RF exposure requirement of low power devices under portable operation. Nevertheless, it is advised to use the Products in such a manner that minimizes the potential for human contact during normal operation."
Panasonic DECT Home Cordless Phone	"FCC RF Exposure Warning: To comply with FCC RF exposure requirements, the base unit must be installed and operated 20 cm (8 inches) or more between the product and all person's body."
HP Printer	"In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20 cm (8 inches) during normal operation."
Apple Watch	"During testing, Apple Watch radios are set to their highest transmission levels and placed in positions that simulate use against the head, with 10mm separation, and on the wrist, with no separation. When placing Apple Watch near your face, keep at least 10mm of separation to ensure exposure levels remain at or below the as-tested levels."
Apple iPod Touch	"During testing, iPod radios are set to their highest transmission levels and placed in positions that simulate use near the body, with 5mm separation. To reduce exposure to RF energy, use the supplied headphones or other similar accessories. Carry iPod at least 5mm away from your body to ensure exposure levels remain at or below the as-tested levels."
Nokia 8110 4G Phone (2019 Manual)	"This device meets RF exposure guidelines when used against the head or when positioned at least 5/8 inch (1.5 centimetres) away from the body. When a carry case, belt clip or other form of device holder is used for body-worn operation, it should not contain metal and should provide at least the above stated separation distance from the body."

Research and Investigations into Industry Influence into EMFs

- Oncology Letters published " Health risks from radiofrequency radiation, including 5G, should be assessed by experts with no conflicts of interest" "There seems to be a cartel of individuals monopolizing evaluation committees, thus reinforcing the no-risk paradigm. We believe that this activity should qualify as scientific misconduct."
    - The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has repeatedly ignored scientific evidence on adverse effects of RF radiation to humans and the environment.
    - "All countries should declare a moratorium on 5G until independent research, performed by scientists without any ties to the industry, confirms its safety or not. 2G, 3G, 4G and WiFi are also considered not to be safe, but 5G will be worse regarding harmful biological effects.
- The Harvard Press Book "Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates"by Norm Alster documents the financial ties between the US federal government's Federal communications Commission (FCC) and how, as a result, the wireless industry has bought inordinate access to—and power over—a major US regulatory agency. Read that here.
- A report released by European Members of Parliments Michèle Rivasi (Europe Écologie) and Dr. Klaus Buchner (Ökologisch-Demokratische Partei) accuses the International Commission on Non-Ionizing Radiation Protection (ICNIRP), an organization many governments consider an authority on the safety of 5G and cell phone radiation, of being under the influence of the telecommunications industry and ignoring the science showing their harmful effects.

  The report written by Hans van Scharen and edited by Tomas Vanheste and Erik Lambert is entitled, "The International Commission on Non-Ionizing Radiation Protection: Conflicts of Interest, Corporate Capture and the Push for 5G." (PDF)
- "Disconnect, the Truth about Cell Phones" by Devra Davis PhD, MPH covers the long history of how the cell phone industry has been long aware of the dangers of cell phones, but twisted the truth, funded elected officials and pulled the wool over the public's eyes.
- The International Journal of Oncology published "World Health Organization, radiofrequency radiation and health – a hard nut to crack (Review)" in 2017 detailing conflicts of interest with ICNIRP and the WHO EMF Project, both started with industry support.
- The Procrustean Approach: An examination of the manipulation of telecommunications standards by political, military, and industrial vested interests at the expense of public health protection.
  Don Maisch PhD, 2010.

- The American Journal of Industrial Medicine published "Secret ties to industry and conflicting interests in cancer research" in 2006 about industry funding of studies such as the Danish Cohort cell phone studies that are often put forward show no harm.
- Molecular and Clinical Oncology published "Appeals that matter or not on a moratorium on the deployment of the fifth generation, 5G, for microwave radiation" in 2020 detailing how ICNIRP is referred to as "a private German non-governmental organization. ICNIRP [that] relies on the evaluation only of thermal (heating) effects from RF radiation, thereby excluding a large body of published science demonstrating the detrimental effects caused by non-thermal radiation."
- Environmental Health published Childhood Brain Tumour Risk and Its Association With Wireless Phones: A Commentary in 2011 about how a study called CEFALO on brain tumor risks for children using mobile phones" – authored by several ICNIRP scientists- did not provide assurances of safety as prompted by the study authors. In a 2019 letter signed by several expert scientists the misrepresentation of the CEFALO study was deemed to "represent scientific misconduct."
- Environmental Research published Extremely low frequency electromagnetic fields and cancer: How source of funding affects results" in 2019 that found almost all government or independent studies find either a statistically significant association between magnetic field exposure and childhood leukemia, or an elevated risk "while almost all industry supported studies fail to find any significant or even suggestive association."
- Neurological Sciences published "Mobile phone use and risk of brain tumours: a systematic review of association between study quality, source of funding, and research outcomes." in 2017 . The review of the literature and meta-analysis of case–control studies found evidence linking mobile phone use and risk of brain tumours especially in long-term users (greater than 10 years) with a significantly positive correlation- higher quality studies show a statistically significant association between mobile phone use and risk of brain tumour. "Even the source of funding was found to affect the quality of results produced by the studies."
- Reviews on Environmental Health published "Inaccurate official assessment of radiofrequency safety by the Advisory Group on Non-ionising Radiation" detailing the conflicts of interest with Public Health England's Advisory Group on Non-ionising Radiation and ICNIRP. The paper concludes, "PHE and AGNIR had a responsibility to provide accurate information about the safety of RF fields. Unfortunately, the report suffered from an incorrect and misleading executive summary and overall conclusions, inaccurate statements, omissions and conflict of interest. Public health and the well-being of other species in the natural world cannot be protected when evidence of harm, no matter how inconvenient, is covered up."
- In 2020, Einar Flydal wrote, "Head of Swiss Radiation Protection Committee accused of 5G-swindle. Nordic countries deceived" documenting the misrepresentation of science and bias in the governmental advisory board for EMF in Switzerland.

- "The Disinformation Campaign—And Massive Radiation Increase—Behind The 5G Rollout" by Mark Hertsgaard And Mark Dowie in The Nation April 23, 2018
- War on 5G: Amsterdam Investigation into Scientists Finds Telecom Influence by Jannes van Roermund and Paul Thacker, De Telegraaf (Amsterdam), Jun 2, 2020 (English translation) on the American Council on Science and Health attacks against Prof. Moskowitz and more.
- 2020 Spain Cambio 16 "Who watches the 5G telephony lobby?" an article detailing the financial ties of the Scientific Advisory Committee on Radio Frequencies and Health (CCARS) and the authors investigation that Telefónica, Vodafone and RECI (Spanish Network of Smart Cities) support CCARS. "Can anyone believe that these "collaborating" entities have any interest outside of their own businesses? Can we trust the reports of a closed ICNIRP-style committee whose management is in the hands of the "union" of telemarketers?"
  2020, Is 5G Going to Kill Us, The New Republic by Christopher Ketcham"Modern public health calamities, from asbestos to auto safety to leaded gasoline and tobacco, often follow a predictable narrative. Industry dismisses the health risk, government regulators shrug and look away, and a beleaguered minority is left to sound the alarm"
  "Health and Cellphones: How Wireless Made Us Think Cell Phones Are Safe" Your Call, KALW 91.7FM San Francisco explores "how big wireless companies used the same playbook as big oil and big tobacco to deceive the public" with guests Dr. Devra Davis and Mark Hertsgaard.
- Democracy Now: How the Wireless Industry Convinced the Public Cellphones Are Safe & Cherry-Picked Research on Risks
- Dr. Starkey presented how the government authorities are misleading the public and dismissing evidence of harm. Dr. Starkey's PPT is a critical look going point by point over the misinformation.
- Project Censored Investigations: How Big Wireless Convinced Us Cell Phones and Wi-Fi are Safe, "PhoneGate:" French Study Finds 9 of 10 Cell Phones Exceed Safe Radiation Limits.
- Seattle Magazine, "UW Scientist Henry Lai Makes Waves in the Cell Phone Industry." Seattle Magazine on Motorola working to create doubt and attack Dr. Lai's research finding DNA damage.