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October 18, 2019

The Honorable Anna Eshoo
United States Representative for California
202 Cannon House Office Building
Washington, D.C. 20515

The Honorable Jeff Merkley
United States Senator for Oregon
313 Hart Senate Office Building
Washington, DC 20510

Re: 1) FDA response to inquiry regarding RFR health and safety and 2) Congressional hearing

Dear Representative Eshoo and Senator Merkley,

I am writing to bring your attention to a number of serious errors and misleading statements made by Jeffrey Shuren and Edward Margarrison of the FDA in a September 9, 2019 letter to you in response to your request for information on the safety of 5G and cellphone and other wireless radiation.

I want to urge you to hold oversight hearings of the FDA and FCC to investigate how these agencies can ignore 1. the recent investigations by the Chicago Tribune and French government that find phones violate FCC limits when in the pocket¹² and 2. the results of a \$30 million National Toxicology Program (NTP) study design FDA previously had vetted that followed the gold standard for such research. It is important that Congress inquire as to what safety studies are underway to ensure public health and the environment do not face unreasonable risks from 5G.

Summary of Main Points:

- The FDA says cancer rates have not increased but the CDC has reported increases in pediatric cancers including brain, renal, hepatic and thyroid cancer. In addition, several studies show rises beginning when the studies investigated cellphone associated tumors such as salivary gland tumors and glioblastoma.
- The FDA states it is only focused on cancer as a health effect of cellphone radiation, but cancer is only one of many serious effects associated with radiofrequency radiation as research has found adverse effects to DNA, brain development, memory and reproduction.
- The FDA states that “the Agency has not seen credible evidence” whereas hundreds of studies have indeed found an effect from wireless frequencies and indicate that increased exposure could have serious consequences.

¹ Gandhi, Om P., (2019). [Microwave Emissions From Cell Phones Exceed Safety Limits in Europe and the US When Touching the Body](#), IEEE Access

² Roe, Sam, (2019). [We tested popular cellphones for radiofrequency radiation. Now the FCC is investigating](#), Chicago Tribune

- The FDA states that epidemiological data supports its position whereas, in fact, several published reviews of the epidemiological studies show the opposite: long-term use of cellphones is associated with increased cancer risk.
- The FDA dismisses the National Toxicology Program study on cellphone radiation with criticisms that are unfounded scientifically.
- The FDA letter lacks any comprehensive scientific report on the FDA's review of the research. Where are the studies they reviewed? How was the research evaluated? Scientists have repeatedly asked for the FDA's systematic review but never received a response to their request. Does the review even exist?

In summary, the FDA is not able to substantiate its opinion that RF limits remain acceptable to protect human health.

At the outset, I should note that their letter does not reference any specific public health, environmental or other human health effects studies conducted on 5G. This letter contains no research on the long term health effects to the public. Indeed, such research does not exist. This is why I and more than 240 other experts in the field have written to the United Nations seeking a moratorium on 5G until such testing can be carried out³. Over two hundred fifty scientists from 42 nations are calling for reductions in exposure to the current wireless systems in use today⁴.

In addition, it should be noted that none of the 5G handsets currently incorporate 5G for voice, but solely for enhancing downloads when connected to 5G networks in urban locations. Thus, these handsets must rely on 3G and 4G cellphones for voice for the foreseeable future.

In the meantime, it is instructive to consider what 5G entails at this time. So-called "small cells" infrastructure will require 3G, 4G and 5G wireless radiation-emitting antennas operating within them as the majority of devices available at this time rely on 3G and 4G. By bringing 3G and 4G antennas within a few feet of homes, schools and bedrooms, this effectively takes wireless signal generators generally sited at some distance from humans on mountain tops, tall buildings and the like and brings them into unprecedented close contact.

Wherever there are 80,000 or more people concentrated in a relatively small area as a football stadium, 5G signals operating at 27 GHz to 300 GHz (radar frequencies) will allow live streaming of videos and the use of social media, providing that individual users have the latest 5G phones. Of course, this presupposes that individuals value being able to attend a live sporting event while also broadcasting to social media, enabling an extraordinary level of multi-tasking. Does it also presuppose that individuals attending a live event are well-informed that they expose themselves and bystanders to firsthand and secondhand doses of biologically active radiation?

Most disconcerting to me, as a former member of the Scientific Review Board of the distinguished National Toxicology Program (NTP), is the FDA dismissal of the NTP bioassay on cellphone radiation.

³ Professor Em. Rainer Nyberg, Ass. professor Lennart Hardell, (2019) 5G Appeal <https://www.5gappeal.eu/>

⁴ Kelley, Elizabeth & Blank, Martin & Lai, Henry & Moskowitz, Joel & Havas, Magda. (2015). [International Appeal: Scientists call for protection from non-ionizing electromagnetic field exposure](#). European Journal of Oncology, Volume 20, pp. 180-182.

This rejection is all the more surprising in light of the fact that throughout the decade-long process of creating this study, the FDA actively sought the original study in 1999, participated in review of proposed methodology in 2003 and provided oversight throughout the project, which followed well-established protocols for animal testing that form the backbone for evaluating potential toxic agents.

Exposure chambers were developed by Swiss engineers who also work closely with industry to provide exposures to rodents within their two-year lifespans comparable to those humans receive in their lifetimes. To reject the findings of the NTP that cellphone radiation at nonthermal levels (no measurable temperature change) can produce malignant rare tumors of the brain, malignant rare tumors of the heart nerve sheath, heart damage and DNA damage is a disservice to science and, frankly, endangers public health.

Specific errors or misleading statements of FDA are detailed below, with corrections immediately following:

FDA Letter states, “cancer rates ... show a slight decrease in brain tumors despite the enormous increase in cell phone use over the last two decades.”

This is a misleading statement that has no relevance to the capacity of cellphones to cause glioblastoma multiforme (GBM)—a specific and highly aggressive form of brain tumor associated with long-term cell phone use. The research the FDA cites on brain tumors for the general population does not take into account data on malignant tumors specifically located in the temporal and frontal lobes. Nor does it account for the CDC research finding increases of brain, renal, hepatic, and thyroid cancers among individuals under 20 years old in the US⁵. In addition, Zada et al⁶ reported a very large increase in tumors located in the cerebellum. If all tumors are lumped together in any analysis with all age groups, this eliminates the ability to detect important patterns, especially in younger age groups. The incidence of glioblastoma multiforme more than doubled in England between 1995 and 2015, according to an analysis⁷ published in 2018. In fact, the types of tumors identified as being caused by cellphone radiation in epidemiological and toxicological studies include not only gliomas but also schwannomas (nerve tumors) and meningiomas⁸.

The specific types of tumors associated with long-term cellphone use are increasing, especially in the young in this country, as detailed in the following published account from a recent peer-reviewed article authored by several authorities in the field (including Anthony B. Miller, MD, who originally served as an expert editor for the International Agency for Research on Cancer monograph on cellphone radiation in 2011, and has written more than 600 peer-reviewed articles, and Colin Soskolne, Mark Oremus, myself

⁵ Siegel, David, et al., (2018). [INCIDENCE RATES AND TRENDS OF PEDIATRIC CANCER — UNITED STATES, 2001–2014](#), Centers for Disease Control and Prevention, Atlanta, Georgia, United States

⁶ Gabriel Zada, Aaron E. Bond, Ya-Ping Wang, Steven L. Giannotta, Dennis Deapen, [Incidence Trends in the Anatomic Location of Primary Malignant Brain Tumors in the United States: 1992–2006](#), World Neurosurgery, Volume 77, Issues 3–4, 2012, Pages 518-524, ISSN 1878-8750.

⁷ Philips, Alasdair, et al., (2018). [Brain Tumours: Rise in Glioblastoma Multiforme Incidence in England 1995–2015 Suggests an Adverse Environmental or Lifestyle Factor](#), Journal of Environmental and Public Health, vol. 2018, Article ID 7910754, 10 pages.

⁸ Hardell, L., & Hardell, L. (2019). [Comments on the US National Toxicology Program technical reports on toxicology and carcinogenesis study in rats exposed to whole-body radiofrequency radiation at 900 MHz and in mice exposed to whole-body radiofrequency radiation at 1,900 MHz](#). International Journal of Oncology, 54, 111-127.

and other distinguished epidemiologists). It is critically important to note the location of the tumor within the brain when looking at associations with cellphone use.

“Although Karipidis et al. (12) and Nilsson et al. (13) found no evidence of an increased incidence of gliomas in recent years in Australia and Sweden, respectively, Karipidis et al. (12) only reported on brain tumor data for ages 20–59 and Nilsson et al. (13) failed to include data for high grade glioma, particularly GBMs. In contrast, others, including the Centers for Disease Control and Prevention, have reported increases in specific types of brain tumors associated with cellphone radiation in the National Toxicology Program and other laboratory studies in human populations of Britain and the US:

[Brain cancer](#) has replaced leukemia as the leading cause of cancer death among US children and adolescents aged 1 to 19 years, according to the Centers for Disease Control and Prevention (CDC)⁹. As Miller et al., 2019 have indicated:

- The incidence of neuro-epithelial brain cancers has significantly increased in all children, adolescents, and young adult age groupings from birth to 24 years in the United States (14, 15).
- A sustained and statistically significant rise in glioblastoma multiforme across all ages has been described in the UK (16), at the same time as there is no evident increase in all brain tumors combined.

The incidence of several brain tumors is increasing at statistically significant rates, according to the 2010–2017 *Central Brain Tumor Registry of the U.S.* (CBTRUS) dataset (17).

- There was a significant increase in incidence of radiographically diagnosed tumors of the pituitary from 2006 to 2012 (APC¹⁰ = 7.3% [95% CI: 4.1%, 10.5%]), with no significant change in incidence from 2012 to 2015 (18).
- Meningioma rates have increased in all age groups from 15 through 85+ years.
- Nerve sheath tumor (Schwannoma) rates have increased in all age groups from age 20 through 84 years.
- Vestibular Schwannoma rates, as a percentage of nerve sheath tumors, have also increased from 58% in 2004 to 95% in 2010-2014.

In addition, salivary gland malignancies, especially parotid, have increased in the United States¹¹. Research studies have found associations between cellphone use and increased risk of these tumor types^{12,13,14}.

The latency for glioma tied with cellphone use in a general population is estimated to be four or five decades, based on analyses of brain cancer data from survivors of the Hiroshima bombing and those who received therapeutic head radiation for *tinea capita*. No evidence of an increase in glioma occurred until 40 or more years after those bombings emitted ionizing radiation, or after radiation therapy had been

⁹ Curtin, Sally C., et al., (2016). [Declines in Cancer Death Rates Among Children and Adolescents in the United States, 1999–2014](#), NCHS Data Brief, Number 257.

¹⁰ Average Percent Change per year

¹¹ Del Signore, Anthony G., et al., (2017). [The rising incidence of major salivary gland cancer in the United States](#), ENT-Ear, Nose & Throat Journal.

¹² Bortkiewicz A et al., (2017). [Mobile phone use and risk for intracranial tumors and salivary gland tumors - A meta-analysis](#), Int J Occup Med Environ Health.

¹³ Siegal Sadetzki, et al., (2008). [Cellular Phone Use and Risk of Benign and Malignant Parotid Gland Tumors—A Nationwide Case-Control Study](#), *American Journal of Epidemiology*, Volume 167, Issue 4, Pages 457–467.

¹⁴ de Siqueira EC et al., (2017), [Does cell phone use increases the chances of parotid gland tumor development? A systematic review and meta-analysis](#) *J Oral Pathol Med*, 46: 480- 483.

received. The increase in cellphone use is relatively recent and the way people use cellphones is changing rapidly, so it is not even reasonable to expect to see evidence of general increase in brain cancer at this time in the general population.

The FDA letter states: “*The main health outcome on which FDA focuses for the current question (regarding whether or not there are safety risks to patients from RFR emitted by cellphone handsets) relates to the onset of cancer formation, known as tumorigenesis.*”

Cancer is only one of many serious effects associated with radiofrequency radiation. By focusing narrowly on cancer risks, the FDA ignores the fact that there are a number of human and experimental studies confirming damage to the reproductive¹⁵, immune¹⁶ and neurological systems from cellphone radiation. The Cleveland Clinic routinely advises men who wish to father healthy children to remove phones and other devices from their bodies due to their own research findings^{17,18}.

Replicated research has found memory damage in teens using cell phones to the head after just a year of use¹⁹. Research consistently finds alterations in the electroencephalogram (EEG) after exposure^{20,21,22,23} and researchers speculate that this could be related to the memory impacts found in the study of teenagers.

“ It may be speculated that our results are related to relatively consistently observed alterations in the electroencephalogram (EEG) during sleep in randomized crossover studies of participants exposed to mobile phone radiation prior to sleep.”²⁴

¹⁵ Singh R, Nath R, Mathur AK, Sharma RS., (2018). [Effect of radiofrequency radiation on reproductive health](#). *Indian J Med Res.*,148 (Suppl):S92–S99.

¹⁶ Yakymenko, Igor, et al., (2016). [Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation](#). *Electromagnetic Biology and Medicine*, vol. 35, no. 2, pp. 186-202.

¹⁷ Hamada, Alaa & Singh, Aspinder & Agarwal, Ashok. (2010). [Cell Phones and their Impact on Male Fertility: Fact or Fiction](#). *The Open Reproductive Science Journal*. 5.

¹⁸ Agarwal, Ashok, Fnu Deepinder, Rakesh K. Sharma, Geetha Ranga, and Jianbo Li. [Effect of Cell Phone Usage on Semen Analysis in Men Attending Infertility Clinic: An Observational Study](#). *Fertility and Sterility* 89, no. 1 (January 1, 2008): 124–28.

¹⁹ Foerster Milena, Thielens Arno, Joseph Wout, Eeftens Marloes, and Röösl Martin. [A Prospective Cohort Study of Adolescents’ Memory Performance and Individual Brain Dose of Microwave Radiation from Wireless Communication](#). *Environmental Health Perspectives* 126, no. 7 (n.d.): 077007.

²⁰ Loughran, S. P., McKenzie, R. J., Jackson, M. L., Howard, M. E. and Croft, R. J. (2012), [Individual differences in the effects of mobile phone exposure on human sleep: Rethinking the problem](#). *Bioelectromagnetics*, 33: 86-93.

²¹ Lustenberger, Caroline, Manuel Murbach, Roland Dürr, Marc Ralph Schmid, Niels Kuster, Peter Achermann, and Reto Huber. [Stimulation of the Brain With Radiofrequency Electromagnetic Field Pulses Affects Sleep-Dependent Performance Improvement](#). *Brain Stimulation: Basic, Translational, and Clinical Research in Neuromodulation* 6, no. 5 (September 1, 2013): 805–11.

²² Regel, S. J., Tinguely, G., Schuderer, J., Adam, M., Kuster, N., Landolt, H. and Achermann, P. (2007), [Pulsed radio-frequency electromagnetic fields: dose-dependent effects on sleep, the sleep EEG and cognitive performance](#). *Journal of Sleep Research*, 16: 253-258.

²³ Schmid, M. R., Loughran, S. P., Regel, S. J., Murbach, M., Bratic Grunauer, A., Rusterholz, T., Bersagliere, A., Kuster, N. and Achermann, P. (2012), [Sleep EEG alterations: effects of different pulse-modulated radio frequency electromagnetic fields](#). *Journal of Sleep Research*, 21: 50-58.

²⁴ Foerster Milena, Thielens Arno, Joseph Wout, Eeftens Marloes, and Röösl Martin. [A Prospective Cohort Study of Adolescents’ Memory Performance and Individual Brain Dose of Microwave Radiation from Wireless Communication](#). *Environmental Health Perspectives* 126, no. 7 (n.d.): 077007.

Yet the FDA has not acted to inform parents about these findings. 95% of teens now report they have a smartphone,²⁵ 68% of teenagers reported that they keep their mobile devices within reach at night and nearly a third of teens sleep with smartphones, cellphones or tablets in their bed²⁶.

Replicated research finds behavioral problems associated with cellphone use (prenatally and postnatally)^{27,28,29}. Experimental studies also indicate that exposures can cause a range of abnormalities in offspring ranging from testicular damage³⁰ to learning³¹ and memory problems³² to brain damage^{33,34}. When women rest a cellphone or wireless device on their pregnant abdomen, the developing brain of the developing baby absorbs the wireless radiation. Research finds higher levels in the final months of pregnancy³⁵. More than 200 doctors, educators and health professionals have signed onto an appeal calling for pregnant women to reduce cellphone and wireless exposure in order to protect the developing brain³⁶.

The American Academy of Pediatrics wrote the FDA calling for updated regulations:

“Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children...Pregnant women may carry their phones for many hours per day in a pocket that keeps the phone close to their uterus.”³⁷

Yet the FDA has not acted to recommend updating regulations nor to inform pregnant women about these research findings and what they can do to reduce exposure.

²⁵ Anderson, M., Jiang, Jingjing., (2018). [Teens Social Media and Technology 2018](#). Pew Research Center.

²⁶ Robb, M. B. (2019). [The new normal: Parents, teens, screens, and sleep in the United States](#). San Francisco, CA: Common Sense Media.

²⁷ Divan HA, Kheifets L, Obel C, *et al.*, (2012). [Cell phone use and behavioural problems in young children](#). *J Epidemiol Community Health*, **66**:524-529.

²⁸ Divan, H., Kheifets, L., Obel, C., Olsen, J., (2008). [Prenatal and postnatal exposure to cell phone use and behavioral problems in children](#). *Epidemiology*. 19(4):523-529.

²⁹ Sudan, Madhuri, Jorn Olsen, Oyebuchi A Arah, Carsten Obel, and Leeka Kheifets. [Prospective Cohort Analysis of Cellphone Use and Emotional and Behavioural Difficulties in Children](#). *Journal of Epidemiology and Community Health* 70, no. 12 (December 1, 2016): 1207.

³⁰ Atasoy, Halil I., et al. [Immunohistopathologic demonstration of deleterious effects on growing rat testes of radiofrequency waves emitted from conventional Wi-Fi devices](#). *Journal of Pediatric Urology*, vol. 9, no. 2, 2013, pp. 223-9.

³¹ Kishore, GK, Venkateshu, KV, Sridevi, NS. (2019). [Effect of 1800-2100 MHz electromagnetic radiation on learning-memory and hippocampal morphology in Swiss albino mice](#). *J Clinical and Diagnostic Research*. 13(2).

³² Aldad, Tamir 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.

³³ Bas, O., et al. [900 MHz electromagnetic field exposure affects qualitative and quantitative features of hippocampal pyramidal cells in adult rat.](#) *Brain Research*, no. 1265, 2009, pp. 178–85.

³⁴ Dasdag et al. [“Effects Of 2.4 Ghz Radiofrequency Radiation Emitted From Wi-Fi Equipment On microRna Expression In Brain Tissue.”](#) *International Journal of Radiation Biology*, vol. 16, 2015, pp. 1-26.

³⁵ Cabot, E., Christ, A., Bühlmann, B., Zefferer, M., Chavannes, N., Bakker, J., van Rhoon, G., Kuster, N., [Quantification of RF-exposure of the fetus using anatomical CAD-models in three different gestational stages](#), *Health Physics*. 107(5):369–381.

³⁶ Signatories on [The Joint Statement on Pregnancy and Wireless Radiation](#).

³⁷ Letter from the American Academy of Pediatrics to the FCC and the FDA, [Comment on the Proposed Rule “Reassessment of Exposure to Radiofrequency Electromagnetic Fields Limits and Policies”](#) published in the Federal Register on June 4, 2013.

The FDA letter says, “the Agency has not seen credible evidence that the roll-out of 5G handsets will lead to additional risk for the population.”

This statement does not even indicate what “credible” evidence of safety the FDA has reviewed that it deems relevant. Where is the FDA report with scientific citations? Scientists have been requesting the FDA evaluation but so far have not been sent any evidence such a report even exists. Furthermore, what does “additional risk” mean? Is the FDA saying that the risk is the same as it would be for current 3G and 4G technology? 5G phones will not operate solely with 5G signals but will rely on 3G and 4G signals for voice for the foreseeable future, according to industry experts. 3G and 4G signals have been associated with increased cancer³⁸ and reproductive^{39,40,41}, neurological⁴² and DNA damage⁴³ in experimental studies, plus a number of studies of humans have associated exposure with serious health risks, ranging from sperm damage⁴⁴ to brain cancer⁴⁵, as indicated in a number of publications^{46,47}.

In addition, this FDA statement fails to take into account new discoveries on the vulnerabilities of the skin—the organ always first exposed to 5G signals. Industry states that they will use millimeter waves for 5G, in addition to the lower frequencies. Millimeter waves do not penetrate the body as deeply as current 3G and 4G wireless frequencies. However, they do not simply bounce off the skin; they are absorbed into the skin⁴⁸. Research by physicists finds that 5G signals have been shown to reach just under the skin where they resonate with [helical shaped sweat ducts](#) and are highly absorbed^{49,50}. This resonance could

³⁸ Lerchl, Alexander, Melanie Klose, Karen Grote, Adalbert F.X. Wilhelm, Oliver Spathmann, Thomas Fiedler, Joachim Streckert, Volkert Hansen, and Markus Clemens. [Tumor Promotion by Exposure to Radiofrequency Electromagnetic Fields below Exposure Limits for Humans](#). *Biochemical and Biophysical Research Communications* 459, no. 4 (April 17, 2015): 585–90.

³⁹ Singh R, Nath R, Mathur AK, Sharma RS. [Effect of radiofrequency radiation on reproductive health](#). *Indian J Med Res*. 2018;148(Suppl):S92–S99.

⁴⁰ Houston, B.J., et al. [The effects of radiofrequency electromagnetic radiation on sperm function](#). *Reproduction*, vol. 152, no. 2, 2016, pp. R263-76.

⁴¹ Avendano, Conrado, et al. [Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility and increases sperm DNA fragmentation](#). *Fertility and Sterility*, vol. 97, no. 1, 2012, pp. 39-45.

⁴² Aldad, Tamir S., Geliang Gan, Xiao-Bing Gao, and Hugh S. Taylor. [Fetal Radiofrequency Radiation Exposure From 800-1900 Mhz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice](#). *Scientific Reports* 2 (March 15, 2012): 312.

⁴³ Panagopoulos, Dimitris J. [Comparing DNA Damage Induced by Mobile Telephony and Other Types of Man-Made Electromagnetic Fields](#). *Mutation Research/Reviews in Mutation Research* 781 (July 1, 2019): 53–62.

⁴⁴ Kesari, Kavindra Kumar, Ashok Agarwal, and Ralf Henkel. [Radiations and Male Fertility](#). *Reproductive Biology and Endocrinology* 16, no. 1 (December 9, 2018): 118.

⁴⁵ Miller, Anthony B., L. Lloyd Morgan, Iris Udasin, and Devra Lee Davis. [Cancer Epidemiology Update. Following the 2011 IARC Evaluation of Radiofrequency Electromagnetic Fields \(Monograph 102\)](#). *Environmental Research* 167 (November 1, 2018): 673–83.

⁴⁶ Bandara, Priyanka, and David O Carpenter. [Planetary Electromagnetic Pollution: It Is Time to Assess Its Impact](#). *The Lancet Planetary Health* 2, no. 12 (December 1, 2018): e512–14.

⁴⁷ Lerchl, Alexander, Melanie Klose, Karen Grote, Adalbert F.X. Wilhelm, Oliver Spathmann, Thomas Fiedler, Joachim Streckert, Volkert Hansen, and Markus Clemens. [Tumor Promotion by Exposure to Radiofrequency Electromagnetic Fields below Exposure Limits for Humans](#). *Biochemical and Biophysical Research Communications* 459, no. 4 (April 17, 2015): 585–90.

⁴⁸ Di Ciaula, Agostino. [Towards 5G Communication Systems: Are There Health Implications?](#) *International Journal of Hygiene and Environmental Health* 221, no. 3 (April 1, 2018): 367–75.

⁴⁹ N. Betzalel, Y. Feldman, and P. B. Ishai. [The Modeling of the Absorbance of Sub-THz Radiation by Human Skin](#). *IEEE Transactions on Terahertz Science and Technology* 7, no. 5 (September 2017): 521–28.

theoretically activate pre-cancerous cells just under the surface, effectively transforming them into melanoma or other malignancies or other proliferative responses. The researchers have cautioned about the need to restrict 5G exposures, noting:

“One must consider the implications of human immersion in the electromagnetic noise, caused by devices working at the very same frequencies as those, to which the sweat duct (as a helical antenna) is most attuned. We are raising a warning flag against the unrestricted use of sub-THz technologies for communication, before the possible consequences for public health are explored.”

Several additional new developments in scientific understanding of the skin are also not considered by the FDA. Specifically, the old paradigm held that the skin was a barrier, effectively sponge-like and relatively inert. The new evolving paradigm indicates that the skin plays a major systemic role possibly involving the immune system, with extensions from the surface throughout the body⁵¹. In *Science* magazine, the skin has recently been found to have a complex of glial sensors that exist just under the surface—that may well be considered a new organ with broad implications for sensation and communication⁵². These glial cells are the same types of cells that can be transformed by cellphone radiation to produce gliomas in the brain, in the NTP study and in epidemiological studies. Called the nociceptive-glio-neural complex, this proposed new organ of the skin may account for the capacity to perceive pain and is believed to extend and have influence throughout the body.

This ability to resonate with the skin may also explain why the skin feels like it is on fire when targeted by the Active Denial System, a non-lethal Department of Defense weapon that works with a high-powered beam of millimeter waves at 95GHz⁵³.

The mechanisms of this new organ are being uncovered by scientists now but are believed to tap into unmyelinated glial nerves located just below the skin surface that form a mesh-like structure between the skin's outer and inner layers. It is not known how deeply the new structures may extend with filament-like protrusions. Note that these glial cells are not protected by myelin—the fatty protective sheath that affords some protection to more mature brain cells as compared with those of infants, toddlers and children.

Another recently discovered property of the skin is also relevant in understanding why skin exposures are relevant. A new mesh-like organ—the interstitium—was first identified last year in a study published in the journal *Scientific Reports*, by researchers from New York University's School of Medicine⁵⁴. This organ appears to weave together surrounding arteries and veins, casing the fibrous tissue between muscles, and lining our digestive tracts, lungs and urinary systems. The discoverer of this new fluid, NYU Professor of Medicine Neil Theise, observed that 70% of the body consists of fluid, 2/3 of which is found within cells. The remaining one-third may well consist of this interstitial fluid that runs throughout the body connecting the lymph system. Thus, the assertion that because 5G only reaches just below the skin surface therefore it is unlikely to have any biological effect does not take into account these important new discoveries

⁵⁰ Betzalel, Noa, Paul Ben Ishai, and Yuri Feldman. [The Human Skin as a Sub-THz Receiver – Does 5G Pose a Danger to It or Not?](#) *Environmental Research* 163 (May 1, 2018): 208–16.

⁵¹ Richmond JM, Harris JE. [Immunology and skin in health and disease](#). *Cold Spring Harb Perspect Med*. 2014;4(12):a015339. Published 2014 Dec 1.

⁵² Karolinska Institutet. (2019, August 15). [New pain organ discovered in the skin](#). *ScienceDaily*.

⁵³ Non-Lethal Weapons Program, [Active Denial System FAQs](#), U.S. Department of Defense.

⁵⁴ PUBLIC RELEASE: 27-MAR-2018, [Newfound 'organ' had been missed by standard method for visualizing anatomy](#), NYU LANGONE HEALTH / NYU SCHOOL OF MEDICINE.

indicating that what lies just beneath the surface does not remain there in living bodies. In fact, it is entirely conceivable that the skin plays a major function for our immune system that in turn affects the chances that disease can arise.

The FDA letter concludes:

“Based on FDA’s ongoing evaluation, the available epidemiological and cancer incidence data continues to support the Agency’s position that there are no quantifiable adverse health effects in humans caused by exposures at or under the current cell phone exposure limits.”

In making this broad assertion, the agency fails to provide detailed references and makes a fundamental methodological error by combining case control studies with so-called cohort studies of human populations. The latter type of study is notoriously inappropriate for evaluating brain cancer tied with cellphone use, for reasons that have been well-articulated by a number of serious experts in the field⁵⁵. These include the fact that when studying a very rare event, such as brain tumors, with rapidly changing exposures, population statistics cannot provide definitive information. Moreover, the largest cohort studied so far consists of fewer than one million persons. As the rate of glioma is less than 7 per 100,000, in this entire population one would expect a baseline rate of no more than 70 gliomas. The capacity to follow such a population over decades to determine whether or not there are significant changes in rates that could be due to cellphone use is obviously limited, given the fast-changing nature of phones, users, and other wireless technology today. Those who find the absence of evidence from cohort studies reassuring confuse this with evidence of absence of an effect. It is not.

FDA Dismissal of the National Toxicology Program

The FDA dismisses the findings of the National Toxicology Program studies on cellphone radiation by putting forth multiple unsubstantiated and unfounded criticisms.

The FDA letter states, *“FDA disagrees with the study’s conclusions because the study design did not reflect the levels to which people are exposed to cell phone use and entailed the same problems as other whole body in vivo animal exposure studies.”*

In fact, the study design was developed in close consultation with experts to provide as much exposure in rodents’ two-year lifetimes as humans get in theirs. As the former National Institutes of Health Senior Study Director of the NTP project, Ronald Melnick, PhD, has explained in a peer-reviewed [publication](#):

“Fact: While the exposure limit to RFR for the general population in the US is 0.08 W/kg averaged over the whole body, the localized exposure limit is 1.6 W/kg averaged over any one gram of tissue (FCC, 1997); for occupational exposures, the limit is five times higher (0.4 W/kg and 8 W/kg, respectively). Thus, the whole-body exposure levels in the NTP study were higher than the FCC’s whole-body exposure limits. Whole-body SAR, however, provides little information about organ-specific exposure levels (IARC, 2013). When an individual uses a cell phone and holds it next to his or her head, body tissues located nearest to the cell phone antenna receive much higher exposures than parts of the body that are located distant from the antenna. Consequently, the localized exposure level is more important for understanding and

⁵⁵ Miller, Anthony B., L. Lloyd Morgan, Iris Udasin, and Devra Lee Davis. [Cancer Epidemiology Update. Following the 2011 IARC Evaluation of Radiofrequency Electromagnetic Fields \(Monograph 102\)](#). *Environmental Research* 167 (November 1, 2018): 673–83.

assessing human health risks from cell phone RFR. When considering organ-specific risk (e.g., risk to the brain) from cell phone RFR, the important measure of potential human exposure is the local SAR value of 1.6 W/kg (the FCC's SAR limit for portable RF transmitters in the US, [FCC, 1997](#)) averaged over any gram of tissue. In the NTP study in which animals were exposed to whole-body RFR at SARs of 1.5, 3, and 6.0 W/kg, exposures in the brain were within 10% of the whole-body exposure levels. Consider the converse scenario. If the brain and whole-body exposures were limited to 0.08 W/kg, then localized exposures in humans from use of cell phones held next to the ear could be 20 times greater than exposures to the brain of rats in the NTP study. Under this condition, a negative study would be uninformative for evaluating organ-specific human health risks associated with exposure to RFR. Therefore, exposure intensities in the brains of rats in the NTP study were similar to or only slightly higher than potential, localized human exposures resulting from cell phones held next to the head.”⁵⁶

The FDA letter says: “These studies were conducted with high power levels of RFR over the whole body of the experimental rodents in intervals (10 minutes on 10 minutes off) for 2 years.”

Contrary to the FDA assertion that exposure was 10 minutes off and on for 24 hours a day, exposures were limited to a time period of 18 hours a day (or a total of 9 hours a day), a level that certainly is comparable to what humans may encounter now given the widespread use of wireless radiation. Levels were set that did not measurably increase body temperature of the animals. In fact, the experimental chambers were designed with FDA approval in collaboration with scientists from the RF fields group at the U.S. National Institute of Standards and Technology (NIST) in Boulder, Colorado and the Swiss national institute for engineering, headed by Niels Kuster⁵⁷.

What makes the dismissal of the NTP study results especially strange is the fact that the FDA nominated the NTP to perform large scale animal studies⁵⁸ and FDA expert scientists were originally part of the Federal Interagency Workgroup that reviewed and approved the proposed NTP experimental study design (including FDA, EPA, FCC, NIOSH, and OSHA), as part of the Toxicology Forum (2003), and at the 25th annual meeting of the Bioelectromagnetics Society (2003). As the Bioelectromagnetics Society 2003 abstract states, the objective of the study is “To evaluate health effects, including carcinogenicity, in laboratory animals exposed for near lifetime to ‘non-thermal’ levels of RF radiation emissions of wireless communication devices.”⁵⁹

Before the findings were announced, NIH scientists repeatedly⁶⁰ discussed [the exposure set up](#) as mimicking human exposure to cell phones stating, “Our studies are designed specifically to mimic the human exposure scenario. The NTP studies are looking at exposures for 10 hours a day. There’s heavy

⁵⁶ Melnick, Ronald L. [Commentary on the Utility of the National Toxicology Program Study on Cell Phone Radiofrequency Radiation Data for Assessing Human Health Risks despite Unfounded Criticisms Aimed at Minimizing the Findings of Adverse Health Effects](#). *Environmental Research* 168 (January 1, 2019): 1–6.

⁵⁷ Wyde, Michael, (2016). [Toxicology and Carcinogenicity Studies of Cell Phone Radiofrequency Radiation](#), National Toxicology Program.

⁵⁸ Nominations from FDA’s Center for Device and Radiological Health, [Radio Frequency Radiation Emissions of Wireless Communication Devices \(CDRH\)](#), Executive Summary.

⁵⁹ Abstracts for the Bioelectromagnetics Society Annual Meeting June 22-27, 2003 Wailea, Maui, Hawaii; [The Bioelectromagnetics Society gratefully acknowledges the following for their generous financial support for the 25th Annual Meeting](#).

⁶⁰ Michael Wyde Ph.D., D.A.B.T., [Presentation on the National Toxicology Program Radiofrequency Research Study](#), 2009.

cell phone users that may approach the 10 hour mark – that may be excessive, but it allows us to fully investigate whether or not there is an effect of cell phone frequency radiation.”⁶¹

The NTP put out a factsheet in 2012 that stated “The NTP is conducting toxicology and carcinogenicity studies in laboratory animals that are designed to simulate the exposure of cell phone users in the United States.”⁶²

The FDA letter says: *Furthermore, no effects were seen in mice of either sex or in female rats.*”

The FDA’s statement is inaccurate as the NTP found several other statistically significant effects in female rats and in the mice. Most important, were the findings of DNA damage and heart damage. As Dr. Melnick has noted, “DNA damage (strand breaks detected with the comet assay) was significantly increased in the brains of rats and mice exposed to GSM- and CDMA-modulated RFR (Wyde, 2016)⁶³.”

The tumor and genotoxicity data (DNA strand breaks), as well as the findings of reduced pup birth weights when pregnant dams were exposed to GSM- or CDMA-modulated RFR and the induction of cardiomyopathy of the right ventricle in male and female rats, were also noted in both sexes.

The cited research in this letter is just a sampling of the research indicating serious harm to humans from wireless radiation. I also have attached a list of scientific research studies. If the FDA is of the opinion that these cited studies are not significant to human health then the FDA should share its full report, if it exists at all, documenting the FDA’s research review on cellphone radiation.

In closing, the Chicago Tribune recently published an exposé of the exposure limits measurement of cellphones by testing facilities approved by the FCC. The Tribune found that all phones they tested exceeded current test guidelines when tested in positions mimicking a phone in the pocket (as if 2 mm distant from a person’s body), some by as much as 5-fold⁶⁴. Importantly, previous investigations by the Canadian Broadcasting Corporation (CBC) and the government of France have found the same results. The French government tests on hundreds of cellphones found radiation excesses that are equivalent up to 11 times the FCC legal limit⁶⁵. The FDA has repeatedly been informed but has taken no action to inform the public. Children and babies are using phones in positions of body contact every day. Yet the FDA has neglected to inform the public that phones can violate legal limits at body contact.

The FDA only has the authority to consider effects from cellphones and consumer devices, but not human and environmental effects from cell towers, and not cell antennas in so-called “small cells.” The 5G network is not just about phones, but also intends to install more than 800,000 new telecommunication towers in the US and operation of literally millions of wirelessly connected devices and machines. No US health and safety agency has jurisdiction to evaluate the human health and environmental effects from

⁶¹ [Cell Phone Radiation Cancer Study Was Designed To Mimic Human Exposure](#) (2016).

⁶² [Cell Phone Radiofrequency Radiation Studies](#) (2011), National Toxicology Program.

⁶³ Wyde, M., (2016). [NTP toxicology and carcinogenicity studies of cell phone radiofrequency radiation](#). BioEM2016 Meeting, Ghent, Belgium.

⁶⁴<https://www.chicagotribune.com/investigations/ct-cell-phone-radiation-testing-20190821-72qgu4nzlfda5kyuhteiih4da-story.html>

⁶⁵ O. P. Gandhi, (2019). [Microwave Emissions From Cell Phones Exceed Safety Limits in Europe and the US When Touching the Body](#), in IEEE Access, vol. 7, pp. 47050-47052, 2019. doi:10.1109/ACCESS.2019.2906017

these networks. What about the impacts to the birds, bees and trees within all the signal coverage areas of these new and proposed microwave antennas that industry proposes to build for 5G?

In light of the lack of a systematic research review on human health and environmental effects, Environmental Health Trust is calling for an oversight hearing that will include staff from the FDA, FCC and EPA plus expert scientists to address health and environmental effects of 5G, cellphone and wireless radiation and, most importantly, the issue of accountability in our federal agencies.

Our scientists are always available to answer any questions.

Thank you for your consideration.

A handwritten signature in black ink that reads "Devra Davis". The signature is written in a cursive, flowing style.

Devra Davis, PhD, MPH
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