

SUMMARY OF
EMF*D: 5G Wi-Fi & Cell phones: Hidden Harms and How to Protect Yourself
Dr. Joseph Mercola, published in 2020
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Notes. Numbers at the end of sentences are references listed in the original book for each chapter. 'The Great Bird Flu Hoax' is another book by Dr Mercola.

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Chapter 1: Understanding EMFs

P 6) There is also an indirect way that **ionizing** radiation damages DNA, and that is by converting the water in your nucleus into one of the most dangerous free radicals in your body, the **hydroxyl free radical**. This highly unstable hydroxyl free radical can then go on to cause its own DNA destruction.

P 7) **Nonionizing** radiation from your wireless devices actually creates carbonyl free radicals - instead of the hydroxyl radicals that ionizing radiation gives rise to - that cause virtually identical damage to your nuclear DNA, cell membranes, proteins, mitochondria, and stem cells.

P 8) The SAR value varies with the source of exposure and the person using the phone. For example, if you are in a rural area or in an elevator or a car, where the cell phone uses more power, your brain will get a greater exposure from the higher power required in these instances. Under certain conditions, the SAR value can be 10 to 100 times higher than reported.

Perhaps you would purchase a low SAR phone to ease your mind. But this would be a false sense of security, because the SAR rating has nothing to do with the true biological damage done by the EMFs emitted by cell phones. It is merely a gauge of the intensity of the heating effect, which provides only the benefit of being able to compare the SAR of one phone to another.

THE IMPORTANCE OF PULSED VS. NON-PULSED EMFS

P 10) In the chapters to come the difference between alternating current (AC), which is pulsed, and direct current (DC), which is non-pulsed will be reviewed.

An AC charge moves in two different directions, and switches between these directions in regular pulses, similar to your heartbeat. Our electric grid delivers an AC that pulses 60 times per second, known as 60 Hertz (Hz) in the United States and 50 Hz in most countries outside the U.S.

Direct current (DC) electricity, on the other hand, flows only in one direction. DC currents are what you experience in nature. The Earth creates a DC magnetic and electric field. DC electricity is based on the idea of a battery sending the electrons in one direction. All batteries are DC.

Your body's nervous system does the same and uses DC for synapses and signals. The sodium-potassium pump in your cells is essentially a battery that produces DC current. As such, your body is designed to work with DC current.

The reason that we use AC electricity over DC electricity is because Nikola Tesla found out that AC can travel greater distances than DC without significant reduction in voltage, which is the pressure of electricity.

This is most unfortunate, because using DC to power the electric grid would have been a far better biological solution - since living organisms have been regularly exposed throughout their biological evolution to the Earth's static electric and magnetic fields, our bodies tolerate DC far better than AC.

P 11) In fact, when there are variations of more than 20 percent in the Earth's natural electromagnetic fields during magnetic storms or geomagnetic pulsations that occur approximately every 11 years due to changes in solar activity cycles, there are **increased rates of animal and human health incidents, including nervous and psychiatric diseases, hypertensive crises, heart attacks, cerebral accidents, and mortality**. 6,7

Since living organisms do not have defenses against variations of greater than 20 percent of natural EMFs, it is realistic to expect that they do not have defenses against man-made EMFs, which vary unpredictably and at 100 percent or more from average intensity.

To make matters even worse, wireless signals use several different frequencies simultaneously, making the variability even higher. This is likely why living organisms perceive the pulsation of man-made EMFs as an environmental stressor.⁵

Also, researchers found exposure to 900 MHz radio-frequency (RF) pulses caused changes in human EEGs (diagnostic tests of brain activity), while the corresponding carrier wave signal (same frequency but continuous instead of pulsed) with the same exposure duration did not.¹⁰

EXTREMELY LOW FREQUENCY EMFS

ELFs have a frequency between 0 and 300 Hz, and are emitted by power lines, electrical wiring, and electrical appliances, such as hairdryers.

As you'll read in [Chapter 5](#), there have been many studies on the link between exposure to power lines and breast cancer, impaired sleep, and childhood leukemia.

MAGNETIC FIELDS VS. ELECTRIC FIELDS

Electromagnetic fields have two components: an electric field and a magnetic field.

Your body has a magnetic field too – both these natural magnetic fields are DC, and measured in units of either tesla (T) or gauss (G).

P 13) An electric current naturally generates a magnetic field around it. If you've ever played with two magnets, you've already experienced the fact that a magnetic field quickly gets weaker with distance. However, there is some evidence that magnetic fields have a danger all their own.

THE HEALTH EFFECTS OF MAGNETIC FIELDS

Much of the research into the health effects of magnetic fields has been related to increases in childhood leukaemia and brain cancers. A study that scanned a collection of data from 1997 through 2013 examined 11,699 cases and 13,194 controls and concluded that "magnetic field level exposure may be associated with childhood leukemia."¹⁶

P 14) Furthermore, in 1979 Nancy Wertheimer and physicist Ed Leeper found that childhood leukaemia rates doubled versus controls for children subjected to only 3 milligauss of magnetic field exposure when in the vicinity of neighbourhood distribution power lines in Denver.¹⁷ This finding was also repeated in a 1988 study conducted by the New York State Department of Health.¹⁸

There is also research linking higher levels of exposure to magnetic fields during pregnancy and an increased risk of miscarriage.^{19,20}

ANOTHER SOURCE OF RADIATION THAT IS HARMFUL TO YOUR HEALTH: DIRTY ELECTRICITY

These transients typically occur whenever alternating current (AC) electricity that runs along power lines (with a frequency standardized to 60 Hz in North America and 50 Hz in the rest of the world) is manipulated into other types of electricity (such as direct current, or DC), when it is transformed to

another voltage using what's called a switched mode power supply, or its flow is interrupted.

Dirty electricity most often ranges from 2,000 Hz (2 kHz) to 100,000 Hz (100 kHz). This is a very special range as it is the frequency in which electric and magnetic fields most easily couple to your body, causing biological damage through a mechanism I will describe later in the book.

P 15) The primary way dirty electricity occurs throughout the world is when an electric motor that uses an AC switching power supply is run, such as in your air conditioner, refrigerator, kitchen blender, TV, or computer. The good news about these sources of dirty electricity is that they are locally produced and easily remediated with filters; I will cover exactly how to do that in Chapter 7.

Instead, utilities use the cheaper route and allow the actual ground to return a good deal of the current, as the Earth is a conductor of electricity. Since dirty electricity rides along with 60 Hz electricity wherever it goes, this practice contaminates soil with dirty electricity.

Another common source of dirty electricity is compact fluorescent light bulbs.

So, an excellent strategy to improve your health is to limit your exposure to fluorescent lights at home and the office.

Newer electronic dimmer switches, which modulate the level of light emitted by bulbs by turning the power source on and off - very quickly for brighter light and more slowly for dimmer light - are also significant sources of dirty electricity. (Older rheostat-based dimmers from decades ago do not cause dirty electricity.)

P 18) The relationship between the rise in electrification and chronic diseases follows an eerily similar trajectory and, I believe, presents a compelling reason why this electrification - and the expansion of devices that emit EMFs that came along with it - is one of the primary reasons for the epidemic of chronic diseases that we are now experiencing.

THOMAS EDISON HERALDS INTRODUCTION OF FIRST ELECTRICAL SERVICES

MANY STILL DON'T HAVE ELECTRICAL SERVICES

P 19) In fact, as of 2016 an estimated 13 percent of the world's population didn't have access to electricity, 22

That means we haven't yet achieved peak EMF saturation on Earth. As more regions of the world become electrified, and as more technology evolves and spreads that produces EMF during its use, our exposure will only continue to grow.

INTRODUCTION OF X-RAYS FORETELLS EMF DANGERS

P 21) Yet, the fact that people were dying because of exposure to X-rays did little to stifle their use. A 1926 New York Times article ...

ANOTHER EXAMPLE OF FAILED DANGEROUS TECHNOLOGY: THE SHOE-FITTING FLUOROSCOPE

When peering into the viewer, one could see the shape of the bones and soft tissues of the foot while wearing the shoe and determine if the shoe fit properly.

The X-ray was located at the bottom of the cabinet, separated from the compartment for the customer's foot by a thin aluminium or lead lining. It pointed straight up, which meant that not only did the feet get irradiated, but so did the legs, pelvises, and abdomens of the people crowded around the contraption.

In fact, the entire body of the child being measured - along with the parent and the salesman - was bathed in radiation; others in the shop were also being irradiated through the walls of the machine.

P 23) A 1950 New York Times article noted that shoe store personnel and customers (both adults and children) who were repeatedly exposed to the fluoroscope throughout the year had an increased risk of suffering from stunted growth, dermatitis, cataracts, malignancy, and sterility. 30

P 24)

In the end, these radiation-spewing machines were unleashed on the public for more than three decades, despite the dangers being well known from the very beginning of their proliferation.

We can't trust technology companies to protect their customers' health, we can't trust the government to protect consumer health, nor can we trust ourselves to consider the potential for harm when introduced to exciting new technologies.

MICROWAVE OVENS USHER A MASSIVE UPTICK IN EMFS INTO HOMES

Another innovation that extended the influence of EMFs in daily life was the development of microwave technology.

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WHAT ALL THIS CONNECTIVITY ADDS UP TO

Your ancestors did encounter electromagnetic radiation from their own cells, the Earth's magnetic field, the atmosphere's electric field, lightning, and, of course, the Sun.

So, how much of an increase in your exposure to EMF have you had in the last 100 years?

The answer is well beyond a billion. It is larger even than one trillion. The truth is, we are exposed to one billion billion more EMFs now than we were just 100 years ago. (In case you were wondering, a billion billion is 10 with 18 zeros).⁴⁹

CHAPTER 2: 5G THE BIGGEST HEALTH EXPERIMENT EVER

The difference between 4G and 5G is the equivalent of the difference between a mountain stream of EMF exposure and a vast ocean of it.

This is because 5G will not replace existing wireless technology, but rather add to it. That means every single person, not to mention every microbe, insect, animal, and plant, will experience an exponential increase in EMF exposure, at a frequency that has not been tested for its long-term health ramifications.

ANOTHER CREATURE ALTOGETHER: MILLIMETER WAVES

Whereas LTE cellular service (and most current iterations of 5G) use radio waves that are 6 GHz or less, eventually 5G will add a bandwidth between 24 and 28 GHz, and later it is expected that a bandwidth above 30 GHz will be added as well.

These frequencies are structurally very different from the ones that power 3G and 4G networks.

Part of the frequencies that 5G will ultimately use will be millimeter waves (MMWs), so called because the length of one wave is less than 10 millimeters.

The main reason that telecommunications companies are turning to MMWs is that their bandwidth is significantly larger than the radio waves that current cell phone and Wi-Fi technologies use. That means a lot more information can be carried on them, enabling data to be transmitted in larger amounts, at a much faster speed, and with significantly shorter wait times.

With 5G, a large number of users in small geographic areas will be able to use MMWs at the same time much more efficiently than 3G or 4G technology is capable of. That means people in a packed stadium for an event will be able to make and receive calls and download data without lag time. It also means that hundreds of thousands of smartphones and appliances will be able to transmit and receive information within one small geographic area.

MMWs present some challenges, however. Primarily they are easily obstructed by physical structures such as buildings, trees, and the walls in your office or home. They can also be easily absorbed by rain and humidity.

This means that significantly more antennas will be required to provide consistent and reliable coverage - not just a few more, but literally **billions** of additional antennas compared to the 300,000 cellular towers that exist today.

THE SMALL CELLS ARE COMING

P 37. In order to ensure connectivity, the 5G network will require the installation of “small cell” stations every 300 feet or so, or ever; 3 to 10 houses in cities. They are called **small cells** because unlike the 90-foot cell towers that 3G and 4G technology use, which are usually spaced one to two miles apart, these antennas are small enough to be mounted on top of utility poles, lamp posts, buildings, and bus stops.

Ultimately many, if not most, homeowners can expect to end up with a 5G cell base mounted right outside or very near their home. Workplaces and educational institutions will also be saturated with small cells. Urban areas will be hit especially hard.

P 38 It also means that there is a high probability of **interference** with all those signals bounding around in close proximity to each other. That’s where a solution called beamforming comes in. **Beamforming** takes one signal and concentrates it into a beam that takes the most direct route to a user - kind of like GPS for cellular signals.

In fact, MMW signals cannot easily penetrate typical building materials like wood, brick, stucco, and even regular glass without being beamformed.

What is important to keep in mind is that these new signals from all these extra antennas and base

stations will be in addition to the EMF swamp that we are all already swimming in. This is because 5G will not replace existing wireless technology, but will merely add to it.

Specifically small cell stations will have never-ending 4G LTE antennas constantly spraying homes with RF signals used to geolocate mobile devices, although, granted, the power of the signal will be somewhat lower than that emitted by standard 4G cell towers.

But these small cell antennas will be so much closer to people's homes, especially second-story bedrooms, that RF from continuous 4G transmitters will be flooding bedrooms with strong RF signals, much stronger than the 4G signals from nearby existing macro cell towers.

Small cells will also send beamformed 5G signals into homes, but primarily when a device inside the home initiates a wireless connection (for example, when someone places a call). So the 5G data signals won't be constant like the 4G signals will be. When 5G data signals do come into your home, they will be strong, focused, and harmful.

THE PROMISE OF 5G

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THE REAL REASON 5G IS BEING DEPLOYED. IT'S NOT FOR YOUR BENEFIT

P 41 All this posturing about the public good is really just a ruse for creating ever higher demand for connectivity and the products that are equipped to capitalize on that connectivity.

It's also about creating a captive audience. Not having to install cable saves money for the telecom companies. As the website TelecomPowerGrab.org put it: **Telecom firms want to beamform 5G into people's homes to save on cabling.** It is that simple.

YOU WON'T BE ABLE TO OPT OUT OF 5G COVERAGE OR THE RADIATION THAT COMES WITH IT

5G ANTENNAS WILL EVEN INFILTRATE YOUR HOUSE

P 43. You may be thinking that since MMWs have difficulty penetrating through walls that you might be protected inside your home. Sadly, this is not the case. So-called smart appliances that use 5G technology will essentially turn your kitchen, laundry room, and outer walls into small cells.

P 44. Even the light bulbs in your home may become 5G transmitters. Starting in 2017, researchers at Brunel University London began developing light bulbs that use both visible light communication (VLC), also known as Li-Fi, which uses the rapid flickering of LED light to transmit digital communication, and MMW 5G technology to create high-speed home wireless networks.^{13, 14.}

5G causes people to feel, cold, paralysed, hallucinations and pain.

THE HEALTH DANGERS OF MMW EXPOSURE

Researchers have examined the health effects of treatment using MMW. Their studies found that up to 80 percent of people can sense the presence of MMWs on their skin,^{16,17} as well as increased electrohypersensitivity,¹⁸ particularly in postmenopausal women.¹⁹

In the minimal additional research recently conducted on the subject, MMW technology was linked to a number of potential health problems, including: 21-25

- Eye problems such as lens opacity in rats, which is linked to the production of cataracts 26 and eye damage in rabbits^{21,28}
- Impacted heart rate variability, an indicator of stress, in rats 29-31 and heart rate changes (arrhythmias) in frogs 32, 33
- Modified structure and function of cellular membranes
- Suppressed immune function 35
- Effects on bacteria, including depressed growth and increased antibiotic resistance. 36

No studies have been done to assess what might be a safe threshold for MMW exposure, a fact that led Washington State University biochemistry professor Dr. Martin Pall, one of the leading voices on the dangers of EMFs, to declare:

“Putting in tens of millions of SG antennae without a single biological test of safety has to be about the stupidest idea anyone has had in the history of the world.”³⁷

Research compiled by the founder of ElectricSense.com and author of EMF Practical Guide Lloyd Burrell³⁸ and others^{39,40} suggests the proliferation of 5G could turn into nothing short of a public health disaster.

MMW EXPOSURE CAN CAUSE PAIN

P 46. MMWs are known to penetrate human skin tissue at a depth of 1 to 2 millimeters,^{41,42} and to cause pain in the skin. ⁴³ This is likely because MMWs trigger the nerve cells in the skin known as **nociceptors** that alert the brain of potentially damaging stimuli by eliciting a pain response.

Another suggested reason for the pain response is that **sweat ducts in human skin act as antennae** when they come in contact with MMWs. ⁴⁴

In a 2016 letter to the FCC, Dr Yael Stein of the Hadassah Medical Center in Jerusalem, Israel, who has studied 5G MMW technology and its interaction with the human body, wrote: ⁴⁵

“Computer simulations have demonstrated that sweat glands concentrate sub-terahertz waves in human skin. Humans could sense these waves as heat. The use of sub-terahertz (millimeter wave) communications technology (cell phones, Wi-Fi, antennas) could cause humans to percept physical pain via nociceptors. Potentially, if 5G WiFi is spread in the public domain we may expect ... more cases of hypersensitivity (EHS), as well as many new complaints of physical pain.”

The U.S. Department of Defence knows very well that MMWs cause pain, because it uses these extremely high frequencies in crowd control weapons known as the Active Denial System (ADS). ⁴⁶ The ADS has the ability to cause a severe burning sensation that feels almost as if the skin might catch on fire.⁴⁷ As a result, people exposed to the ADS will instinctively retreat.

5G COULD ALTER ALL BIOLOGICAL LIFE AND CHANGE THE ENVIRONMENT IN UNFORESEEN WAYS

P 47. Studies have already shown that MMWs may invoke stress protein changes in plants such as wheat sprouts.⁴⁸

Insects, being millimeter-size creatures, serve as mini-antennas for MMWs. A recent review of the world literature on plummeting insect populations predicts the extinction of 40 percent of the world's insect species over the next few decades, even without the implementation of 5G.⁴⁹

SMALL REASONS FOR HOPE: A BRIEF HISTORY OF RESISTANCE TO 5G

P 51 Although 5G appears to be as unstoppable as a runaway freight train, there are some city and national governments around the world and in the U.S. who have at least constructed some speed barriers. **Florence, Rome, Canton of Vaud Switzerland, Russia and Brussels have all stopped or limited unrolling of 5G. Many USA cities are trying to oppose 5G.**

P 56 THE BEST ALTERNATIVE TO 5G - FIBER-OPTIC NETWORKS

Even ancient phone lines have been shown to be able to deliver gigabit data rates, and fibre-optic cables have a proven ability to deliver 1.4 terabits of data per second, (89) orders of magnitude higher than 5G.

CHAPTER 3: CELL PHONES ARE THE CIGARETTES OF THE 21ST CENTURY

P 60 If you want to review all the sordid strategies the tobacco industry successfully and brilliantly deployed that prematurely killed millions of people, I encourage you to read Harvard University professor Allan M. Brandt's comprehensive review, 'Inventing Conflicts of Interest: A History of Tobacco Industry Tactics'¹ (https://ideas.repec.org/a/aph/ajpbhl/10.2105-ajph.2011.300292_8.html) and former assistant secretary of labour for occupational safety and health David Michaels' book 'Doubt Is Their Product: How Industry's Assault on Science Threatens Your Health.'

THE TOBACCO INDUSTRY PURPOSEFULLY LIED TO THE PUBLIC FOR DECADES

FUNDING BIASED RESEARCH

SPENDING MILLIONS TO SWAY LEGISLATORS

CREATING CONFLICTS OF INTEREST

FUNDING STUDIES OF QUESTIONABLE DESIGN

BROADCASTING THE MESSAGE THAT THE SCIENCE IS INCONCLUSIVE

P 67 Martin Blank, Ph.D., wrote in his book 'Overpowered'.

'If there are 100 studies done on the safety of cell phones and 50 of them (in most cases, those funded by the industry) find no harmful effects and 50 of them do, then the wireless companies can claim that "the science is mixed," when in reality the science that is not funded by the industry is actually quite clear.'

P 71 SMEARING SCIENTISTS WHO FIND PROBLEMS WITH CELL PHONES

It's not only industry that has sought to stifle research into the biological effects of EMFs – the military has done it too. One of the premier researchers in this area, Dr Allan Frey, began researching how microwave frequencies affect the body in 1960. At the time, Frey was 25, a young neuroscientist working at General Electric's Advanced Electronics Center at Cornell University

From these early days, Frey was interested in how electrical fields affect brain function. So when he received a call from a radar technician who made the incredible claim that he could "hear" radar, Frey eagerly went to the site to evaluate why this radar might be audible. Sure enough, he could hear it too—a low level, persistent humming. "I could hear the radar going 'zip, zip, zip,'" he later reported.

Intrigued, Frey began an investigation that ultimately led him to realize that the **ear did not record the radar sounds, the brain did.** This is now called the "**Frey effect**" and caused quite a stir in the scientific community.

For 15 years Frey enjoyed the support he received from the military to test the potential effects of EMFs on the body. What he found was remarkable. He showed that **rats became docile** when P 73 exposed to radiation levels of 50 microwatts per square centimeter. Then he showed that **he could change rat behaviour** at exposures to 6 microwatts per square centimeter.

Next, **he stopped a frog heart** - stopped it dead - at 0.6 microwatts per square centimeter. This is particularly remarkable when you consider that 0.6 microwatts per square centimeter is 10,000 times less than your cell phone emits when you have it pressed to your ear on a call.

"CAPTURING" THE FEDERAL COMMUNICATIONS COMMISSION

There is one way that the wireless industry has surpassed Big Tobacco - and that is by using its money and influence to get insiders appointed to government agencies charged with regulating its products, namely the Federal Communications Commission (FCC).

The FCC in particular is frequently referred to as a "captured agency" thanks to Norm Alster of the Edmond J. Safra Center for Ethics at Harvard University, who in 2015 wrote a short book titled '**Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates.**'

As a captured agency, the FCC is a prime example of institutional corruption.

HOW THE WIRELESS INDUSTRY INFLUENCES GOVERNMENT POLICY

P 76. A natural consequence of all the efforts to sow confusion about the true risks of wireless radiation and to infiltrate regulatory agencies is that the government as well as nongovernment organizations charged with safekeeping public health falter.

CHAPTER 4: HOW EMFS DAMAGE YOUR BODY

P 84 The wireless industry has long held that radiation from its devices produces no thermal damage in humans. This assumption is precisely what the existing safety standards are based on.

Yet this assumption is incorrect and myopically focused because **cell phones do have heating effects.**

Literal hot spots in the brain have been shown to occur as a result of exposure to the radiation emitted by cell phone antennas, largely as a result of the structure of your skull.¹

The U.S. government first published documents acknowledging the existence of the harmful effects of EMFs nearly 50 years ago. This included the 1971 D.S. Naval Medical Research Institute reports and a follow-up report from the National Aeronautics and Space Administration (NASA) in 1981. ³

The science documenting the health effects of EMFs that have emerged since these early papers were written has been catalogued in the **BioInitiative Report**, published in 2012 by the BioInitiative Working Group, a collective of 29 authors from 10 countries, including 10 MDs, 21 PhDs, and an M.Sc., M.A., and M.P.H.

P 85 The group released an update in 2017, a massive 650-page report that contains 1,800 new studies. If you are interested, I suggest downloading it at <https://bioinitiative.org>.

An even more comprehensive collection of studies on EMFs is compiled at the **EMF-Portal** (www.emf-portal.org/en). It lists nearly 30,000 studies with more than 6,300 summaries and you can view a list of the publications for the last 30 days.

If you don't want to pore through hundreds and hundreds of pages of research, Dr Martin Pall prepared a summary of some of the best literature in this area, (4) and I have included a list of the studies Pall summarizes in Appendix B of this book. Perhaps these are two better places to start a serious review of the science.

As important as these tens of thousands of studies are because they show that cell phone exposure is connected to many different diseases in your body, (5) they were largely observational and none of them illuminated a solid mechanism of how EMFs actually affect your biology.

Thankfully, recent research has elucidated some of the mechanisms of how exposure to non-ionizing EMFs may impact your biology other than thermal damage. A lot of this work dovetails with the past 15 years of cancer research, which has focused on intermediary cellular metabolisms, expanding our understanding of how basic cell function is a central driver of an ever-growing number of human diseases (6).

A NEW UNDERSTANDING OF EMFS AND YOUR BIOLOGY; IT ALL STARTS WITH CALCIUM

P 86 Your body uses about 98 percent of its calcium to keep your bones and teeth strong,(7) thereby supporting your skeletal structure and function.

Calcium has many other roles that are each absolutely essential to your health, including:

- Cell signalling
- Regulating enzyme and protein functions
- Muscle contraction
- Blood clotting
- Nerve function
- Cell growth
- Learning and memory

It is **calcium's role as a biological signalling molecule that is affected by EMF exposure**. The first

important fact to understand is that calcium is far more concentrated outside of your cells than inside. In fact, the amount of calcium outside your cells is 20,000 to 100,000 times higher than the level inside your cells.(8)

P 87. It's also important to note that calcium doesn't flow freely from outside to inside your cells. Rather, your cells have evolved a very elegant way to tightly regulate and control their level of calcium. This fine-tuning of calcium levels is necessary to allow the mineral to maintain precise control over the many areas of your body that it is responsible for.

If this highly regulated system is distorted, it can wreak **metabolic havoc** in your body. And this is precisely what happens when you are exposed to **excessive EMFs**. This finely tuned control of calcium from outside your cells to the inside occurs through tiny ion channels embedded in your cell membranes.

Scientists have given these ion channels a more technical term that we will use throughout the rest of this book: voltage-gated calcium channels (VGCCs). There's a popular class of drugs that works on the VGCCs known as calcium channel blockers. They are used primarily to relax blood vessels for individuals with high blood pressure, and to help normalize certain types of abnormally rapid heart rhythms.

THE CONNECTION BETWEEN EMF EXPOSURE AND CALCIUM

P 88. It seems quite clear that the way EMFs damage your cells is by **increasing oxidative stress** in your cells, and that this damaging process involves intercellular calcium.

The discovery that exposure to EMFs increases calcium levels inside the cells dates back to the early 1990s.(9)

In 2013 Martin Pall published a study, updated in 2018, (10) in which he described his theory of the mechanism of how EMF exposure increased calcium inside the cell. Pall came to his conclusions by reviewing 26 studies where investigators used calcium channel-blocker drugs, the same drugs that are prescribed to patients with high blood pressure, to examine their effects on VGCCs when EMFs were present.

Amazingly, research confirmed that when calcium channels were blocked, the damage that the EMFs caused was radically reduced, providing very compelling evidence that the calcium channels were responsible for facilitating the damage from the EMF.

The researchers found that when EMFs activated the VGCCs, after about five seconds the channels opened up and flooded inside of the cell with an unhealthy amount of calcium ions at the rate of about one million per second.

EMFs also disrupt the flow of calcium once **inside** your cells, allowing too much of it to pass into your **mitochondria**.

Your mitochondria are generally referred to as the energy producers of your cells as they have the enzymes and machinery to create adenosine triphosphate (ATP), which is the primary energy currency of your cells.

When calcium inside your mitochondria increases, it leads to a series of damaging states, including a lowered ability to generate ATP and increased oxidative stress that eventually contributes to

premature cell death. (12) There are many, many reasons to avoid unnecessary EMF exposures, but keeping your mitochondria healthy is one of the most important ones.

Humans are not the only species who have channels allowing calcium to flow in and out of cells. (13) They are in all plants and animals. The VGCCs in plants are constructed differently, but they function very similarly to the ones we have, essentially serving as ways to regulate the flow of calcium into and out of cells.

As I'll discuss more later in this chapter, the fact that VGCCs exist in both plants and animals is a powerful illustration of how EMFs impact virtually all forms of living things exposed to them, and therefore have enormous environmental consequences. (14)

Despite the number of studies showing a direct relationship between EMF exposure and VGCC activation, it is still a theory, and not one that everyone agrees with.

Dr Henry Lai, a prominent EMF researcher whose work has shown evidence of EMFs' ability to cause DNA damage, agrees that VGCCs are an important area to investigate, but he maintains that there are many unanswered questions about the theory. You can read about them on Dariusz Leszczynski's blog, '[Between a Rock and a Hard Place](#)'. (15)

THE PROBLEM WITH EXCESS CALCIUM IN YOUR CELLS

P 90. When too much calcium is released into your cells it can trigger a chain of events that can increase your risk of diseases, especially cancer, and premature aging.

So, what happens when excess calcium floods into your cells?

The answer has to do with free radicals, which are any molecules that have been damaged and, as a result, have an unpaired electron. Unpaired electrons are what make free radicals highly reactive and potentially very damaging. (16)

The broad strokes of how EMFs do damage is that they release excess calcium into your cells, which then initiates a cascade of molecular events that ultimately result in an increase in free radicals. These highly reactive molecules then proceed to travel and damage your cell membranes, proteins, mitochondria, and stem cells, and not only your mitochondrial but also your nuclear DNA. (17)

Interestingly, this is the precise end result that sources of ionizing radiation, like X-rays and gamma rays, produce, as I reviewed in Chapter 1.

The media and the wireless industry will try to tell you that the information in this book is simply not true. This is why I want to provide you with the detailed biological impacts so you can confront these sources with the science that will refute their assertions of wireless safety.

When extra calcium ions rush into your cells, they cause an increase in both nitric oxide and superoxide. At first glance this may not seem like a bad thing, because although these two molecules are free radicals, they are relatively benign and each plays many important roles in your body (I will explain more about those functions in just a moment).

But once you unleash loads of them all at once and they come very close to each other, they will spontaneously combine and can instantly form one of the most damaging molecules in your body, peroxynitrite. Therefore, it's not nitric oxide and superoxide themselves that are the issue, it's the

fact that when they occur in large amounts in close proximity to one another they produce the dangerous molecule **peroxynitrite**, which is harmful.

And they don't produce just a little of it. Even a modest increase in nitric oxide and superoxide results in an **exponential rise in peroxynitrite**. A tenfold increase in nitric oxide and superoxide will increase peroxynitrite formation a hundredfold.

Once it is formed, peroxynitrite starts attacking important biological molecules that damage your cells, cause disease, and lead to premature death. **Peroxynitrite can damage nearly every significant tissue in your body, such as your precious cell membranes, (18) proteins, (19) mitochondria, (20) stem cells, (21) and DNA. (22)**

Peroxynitrite-Induced damage cues an **inflammatory** response from your immune system. **Once your body is inflamed (Kawasaki Disease in children?), even higher concentrations are possible, increasing nitric oxide and superoxide a thousandfold, which means a potential millionfold rise in the formation of peroxynitrite. (23)**

Because it inflicts damage on so many of your vital tissues, you can begin to understand how peroxynitrite is one of the most pernicious **toxins** you can be exposed to. Keeping your levels of this toxin low will radically decrease your risk of chronic degenerative diseases and will slow down the aging process in your body.

SUPEROXIDE: A BENEFICIAL FREE RADICAL WITH A DARK SIDE

P 92. Let's back up a moment and learn a little more about the two molecules that combine to form peroxynitrite: nitric oxide and superoxide. We'll start with the latter.

Superoxide is an important biological signalling molecule. (24) It is also a free radical. From its name, it sounds like it would be a super-oxidizing molecule. But the truth is that superoxide is actually relatively weak because it is more likely to surrender its electron than to accept an additional electron from another molecule.

Under good health conditions, superoxide is not particularly toxic because your body has efficient means to minimize its accumulation - namely, scavenging enzymes such as superoxide dismutase (SOD), which quickly remove superoxide from circulation-and you don't produce all that much of it during the regular course of metabolizing food into energy.

The problems arise when your health is less than optimal because you are burning carbohydrates as your primary fuel instead of fat. **In other words, if you're eating too many carb-rich foods and rarely go longer than a couple hours without eating.**

If you read my book 'Fat for Fuel', you probably recall that your body can burn either carbs or fat in order to make energy, and that **burning carbs produces far more free radicals than burning fat**. So, when you eat - and therefore burn - primarily carbs, you expose your mitochondria and your cells to significantly more free radicals, including superoxide.

While I go into great detail about how to tell if you are burning fat or carbs in Fat for Fuel, I'll give you the brief version here. For a general idea of whether you are burning fat or carbs, answer the following questions:

1. Are you overweight? (Is your body mass index higher than 25?)

2. Do you have diabetes?
3. Do you have, or have you had, heart disease?
4. Do you have high blood pressure (130/80 or higher)?
5. Is your waist-to-hip ratio greater than 1 (men) or 0.8 (women)?

If you have answered yes to any of these conditions, odds are good that you are burning carbs. If you don't have these ...

THE RELATIONSHIP BETWEEN THE FOOD YOU EAT AND DAMAGE CAUSED BY EMFS

P 94. The process of converting the food you eat into energy, in the form of adenosine triphosphate (ATP), is not 100 percent efficient. Even if you are healthy, it is still only somewhere between 95 and 97 percent efficient.

Meaning, some electrons will leak out of the energy generation mechanism known as the electron transport chain in your mitochondria and form what are called reactive oxygen species (ROS). ROS are unstable oxygen atoms that have gained one or more unpaired electrons and can damage your tissues. Superoxide is an ROS.

When you rely on burning carbs for fuel you will generate 30 to 40 percent more ROS, including superoxide, as the process of burning carbs leaks **far more electrons** into your mitochondria than burning fat does. The more superoxide you make through poor dietary choices and timing of your meals, the more damaging peroxynitrite your body will create. (26, 28).

A poor diet increases oxidative stress.

HYDROXYL FREE RADICALS

Let's examine the ROS that are produced during this process in more detail as they impact what happens to your body when you are exposed to EMFS.

Because superoxide has a limited reactivity, there was considerable controversy among researchers in the 20th century about what role it plays in cell toxicity. 29 They were perplexed as to what could cause most of the oxidative damage inside the cells if it wasn't superoxide. They eventually learned that the true villain was actually a cousin, the hydroxyl free radical. Hydroxyl radicals are hyperreactive and will combine with virtually any biological molecule within a very short distance.

P 96. Similar to superoxide, hydroxyl free radical are normally made in your mitochondria in the process of burning food for fuel. There is a slight difference between the mechanisms that create these two different molecules though, as iron is required as a catalyst to form hydroxyl radicals.

Like most things in life, the hydroxyl radical theory only lasted so long. While hydroxyl radicals do play a role in oxidative stress, they are very short lived, lasting only about a billionth of a second. This radically limits the distance they travel, usually less than the diameter of the typical protein, before they perish and cease their destructive damage.

Since the vast majority of hydroxyl radicals are created in your mitochondria and they can only travel very short distances, they simply do not have enough time to pass out of the mitochondria and into the nucleus, where they could damage your nuclear DNA. Therefore, most of the damage they cause is limited to your mitochondria.

We now realize that the biological relevance of hydroxyl radicals is seriously limited because of its incredibly short life span. Yet the hydroxyl free radical theory is still widely described in many pathology textbooks.

A far better explanation of superoxide toxicity became apparent with the discovery of **nitric oxide**. It is now widely appreciated that when both superoxide and nitric oxide are produced within a few cell diameters of each other, they will combine spontaneously to form the highly pernicious **peroxynitrite**, (30) And peroxynitrite seems to be a champ at causing cellular destruction in your body, as we will cover in the following section.

MEET NITRIC OXIDE: ANOTHER BENEFICIAL FREE RADICAL WITH A DARK SIDE

Very few molecules can compete with the magnitude of impact that nitric oxide has had on biology since its discovery in 1980. (31) When scientists finally started to understand the biology of nitric oxide it challenged some of the foundations of biological thinking.

Nitric oxide is a small molecule comprised of oxygen and nitrogen atoms that readily crosses your cell membranes as a colourless gas. Even though nitric oxide is a free radical, it has many beneficial effects in your body:

- It regulates the tone of your blood vessels through its ability to relax them and help normalize blood pressure. (32)
- It plays a crucial role in controlling infections. (33)
- It decreases platelet aggregation or the tendency of blood to clot, thus decreasing the risk of blood clots leading to stroke or heart attack. (34)
- It promotes new blood vessel formation, a process called angiogenesis. (35)
- It helps prevent erectile dysfunction (36)

Many people are actually deficient in nitric oxide and therefore benefit from strategies to increase their levels. Rather than taking potentially dangerous drugs such as Viagra, which increase nitric oxide, you can increase your intake of plant-based dietary nitrates from foods such as **arugula**, or take nitric oxide precursors, like **arginine or citrulline malate**, as supplements (or in food) in order to achieve healthy levels of this beneficial molecule.

P 98. Nitric oxide is mostly made in the inner layer of your blood vessels; since your **blood vessels are the primary users of nitric oxide**, this is where the bulk of it is produced and stored until it is needed. The important point to recognize here is that nitric oxide is not ordinarily stored inside your cells, nor does it float around just waiting to be used. It is far too reactive to do that.

Rather, **it is bound to molecules like glutathione, heme, and other proteins**. This is where **EMF exposure** is such a major concern, because one of the results of all the extra calcium that rushes into your cells when exposed to EMFs is that it **causes this stored nitric oxide to be released**, increasing the levels of nitric oxide inside your cells.

This EMF-induced nitric oxide increase might seem beneficial, but nitric oxide's positive effects occur only when it is produced naturally outside your cells. The problem with elevated levels inside your cells is that nitric oxide is highly reactive, meaning **it quickly combines with superoxide**, the other free radical that increases when there is excess calcium in your cells.

This combination then forms peroxynitrite, and this process is radically accelerated when you are eating an unhealthy diet as described earlier, because you have more superoxide for the nitric oxide

to react with and form peroxynitrite.

PEROXYNITRITE MAY BE ONE OF THE MOST DAMAGING MOLECULES IN YOUR BODY

The primary reason peroxynitrite is more biologically pernicious than hydroxyl free radical is because it lives about 10 billion times longer, meaning it has loads more time to damage your tissues.

Peroxynitrite is not technically a free radical. Rather, it is a strong oxidant that reacts relatively slowly with most biological molecules. It also is not classified as a reactive oxygen species (ROS) because unlike ROS it has nitrogen in its structure. So, it is called a reactive nitrogen species (RNS).

The damage peroxynitrite induces is the result of its primary breakdown product, carbonate free radicals, which likely causes far more serious damage to DNA than hydroxyl free radical.

The carbonate free radical lives much longer than the hydroxyl free radical, albeit only thousands of times longer, not billions like peroxynitrite. When you combine the half-lives of these free radicals, you can begin to appreciate why the cascading domino of free radicals resulting from EMF exposure is so damaging.

In fact, peroxynitrite is the only known molecule that has both a long enough half-life to travel within and between cells and the ability to break DNA bonds. (37) It lives more than long enough to travel relatively great distances and can easily cross cell membranes and penetrate the nucleus where it creates carbonate free radicals to trigger breaks in the strands of your DNA.

As if that weren't reason enough for concern, peroxynitrite accelerates the damage to your body by inhibiting superoxide dismutase (SOD). This is the scavenging antioxidant enzyme that P 100 neutralizes superoxide and converts it to another free radical, hydrogen peroxide, which is then typically converted to water.

When peroxynitrite inhibits SOD it has the effect of increasing available superoxide to combine with nitric oxide and creating a vicious cycle of even more peroxynitrite, because peroxynitrite is formed nearly every time superoxide and nitric oxide get close to each other. Nitric oxide and superoxide do not even have to be produced within the same cell to form peroxynitrite, because nitric oxide can readily move through membranes and between cells.

Even the generation of a moderate amount of peroxynitrite over long periods of time will result in substantial oxidative damage. This leads to the impairment of critical cellular processes. It disrupts important cell signalling pathways and damages your mitochondria, which then decreases your ability to create energy in the form of ATP.

Long term, peroxynitrite causes inflammation and ultimately damages your tissues, contributing to cardiovascular disease, neurodegenerative disease, diabetes, and many other conditions, most of which have been scientifically linked to EMF exposure, as I'll explain in the next chapter.

WHY YOU LIKELY HAVE NEVER HEARD OF PEROXYNITRITE

Thankfully there is a great resource for those with science training who want to learn more about peroxynitrite, and best of all it's free. It is an epic paper called "Nitric Oxide and Peroxynitrite in Health and Disease" that has nearly 1,500 references and can be reviewed at no charge by typing the title into your favourite search engine. (40) (Pacher P, Beckman JS, Liaudet L. "Nitric Oxide and Peroxynitrite in Health and Disease." Physiological Reviews. Vol. 87, no. 1. (January 2007); 315-424.

Doi: 10.1152/physrev.00029. 2006).

This paper was written by three leading scientists funded by the National Institutes of Health (NIH). It is a 140-page, landmark comprehensive review documenting how elevated levels of peroxynitrite cause extensive cellular damage that **disrupts at least 97 critical biological processes and, as a result, are associated with more than 60 chronic diseases.** The beginning of this article is a must read for any serious student of EMFs.

NON-IONIZING RADIATION ALSO DAMAGES YOUR DNA

Contrary to popular belief, most of the damage that ionizing radiation causes is not by breaking your DNA's covalent bonds directly, it is actually a result of interacting with the water in your cells, and more specifically your nucleus.

When ionizing radiation hits the water in your nucleus it creates dangerous hydroxyl free radicals. As you learned in the section above, hydroxyl radicals are unable to travel very far, but since the ionizing radiation can create these radicals in the nucleus right next to your nuclear DNA, they are able to inflict damage on your DNA and cause single- and double-stranded breaks.

But it is not true that non-ionizing radiation is incapable of damaging DNA. It can, and it does, through the production of peroxynitrite and its secondary creation of carbonate free radicals. It has become clear that **peroxynitrite production is the missing link that connects the dots as to why non-ionizing radiation can be every bit as damaging as ionizing X-rays.**

The German EMF researcher Franz Adlkofer used a comet assay, which is a very sensitive test for DNA damage, in a 2008 study. (41) He found that very **low intensity EMF exposure at 1.8 GHz produced large numbers of DNA breaks. It actually produced more DNA damage than 1,600 chest X-rays.** (42)

Adlkofer did another comparison study (43) and from this comparison, it seems clear that **non-ionizing radiation similar to 3G radiation can be much more dangerous to the DNA of your cells than a similar energy of ionizing radiation.**

Now we know that the reason **EMF exposure can result in extraordinarily high levels of peroxynitrite** is that there are three steps in the process, each of which has high levels of amplification. When you have three amplification steps in sequence (see below), You can get a very large response from a very small initial signal:

- When the VGCC channels are open, they allow the Influx of about a million calcium ions per second into the cell.
- That elevated calcium inside your cells then activates the synthesis of both nitric oxide and superoxide
- Peroxynitrite is formed in proportion to the product of nitric oxide concentration times the superoxide concentration.

These three steps occur more frequently in some cells than in others. That is because all your cells have VGCCs, but certain tissues have far higher concentrations of them, as they rely more on calcium to regulate their function. These tissues include your **brain, your heart, and your reproductive organs - the very tissues that are impacted most when you are exposed to EMFs.**

Depression, attention deficit hyperactivity disorder (ADHD), and autism; neurodegenerative diseases

like Alzheimer's; and declining fertility rates have exploded in the past two decades. And, as I'll discuss later in this chapter, **the risks of EMF exposure to children are even greater than they are for adults**. But first, you need to understand that humans aren't the only beings who are negatively impacted by EMF exposure.

ALL LIVING THINGS ARE VULNERABLE TO EMFS

There have been at least two major reviews of studies that have evaluated the biological and ecological effects of EMFs on all life forms. One, published in 2012 in *Biology and Medicine*, examined nearly 1,000 research papers on birds, bees, plants, animals, and humans. Negative impacts were discovered in 593 studies, while only 180 showed no effect and 196 were inconclusive. (44) (Sivani S, Sudarsanam D. "Impacts of Radio-frequency Electromagnetic Field (RF-EMF) from Cell Phone Towers and Wireless Devices on Biosystem and Ecosystem: A Review." *Biology and Medicine*. Vol. 4, no. 4. (2012): 202-16. http://www.biomedonline.com/Articles/Vol4_4_2012/Vol4_4_202-216_BM-8.Pdf.)

A 2013 review of 113 studies found that 65 percent of those studies reported significant negative effects from EMFs, whether at high or low dosages. Half of the studies demonstrated harmful effects on animals, and 75 percent showed negative influence on plants, with the most pronounced effect on the development and reproduction of birds and insects, 45,46

INSECT POPULATIONS ARE BEING DECIMATED

EMFs are believed to have a major role in colony collapse disorder (CCD), the widespread collapse of bee colonies around the world. Where there were 6 million honeybee colonies in the U.S. in 1947, by 2012 only 2.6 million remained, (47) a number that has held fairly steady since then.48,49

The decline in bees coincided with the rise in man-made EMFs, as most of the decrease has happened in the 21st century.

PLANTS AREN'T EXEMPT EITHER

P 106. Just as EMFs wreak havoc in the human body by activating voltage-gated calcium channels, allowing excess calcium to flow into cells, they do the same to plants. (58) This is because plants have calcium channels that respond very similarly to our VGCCs.

As you likely recall from earlier in this chapter, activating VGCCs is the trigger for the oxidative stress caused by EMFs. That means plants experience oxidative stress and DNA damage similar to what humans and animals experience, as well as thinner cell walls, smaller mitochondria, and increased emissions of volatile compounds. (59)

When a calcium channel blocker was applied to the leaf surface, the leaf did not respond to the EMFs. (60)

A 2017 study found that many important food plants seem more susceptible to EMF-induced damage than others, including maize, peas, tomatoes, and onions. (63)

DISEASE-CAUSING BACTERIA APPEAR TO BE EMBOLDENED BY EMF EXPOSURE

Since EMFs can effect changes even at the cellular level within the bodies of living things, it makes sense that they can also have an impact on bacteria. Especially when you learn that bacteria

communicate with one another using electronic signals.

1). Exposure to household wiring has been shown to activate Epstein-Barr virus bacteria that had been dormant, (6)

(2). One of my early mentors, Dr Dietrich Klinghardt, founder of the Sophia Health Institute in Woodinville, Washington, has research that demonstrates that **bacteria such as candida (aka yeast) and mould produce exponentially more toxic by-products when in the presence of non-thermal radiation** - perhaps in an attempt to protect themselves from the invisible assault.

Research has also found that yeast strains seem to grow more quickly when exposed to EMFs.66,67

(3). And it appears that cell phone and Wi-Fi signals could play a role in certain types of bacteria - in the case of this study, E. coli and listeria became resistant to antibiotic treatment. 68

THE ANIMAL KINGDOM IS ALSO AFFECTED

There are multiple mechanisms by which EMFs interfere with the animal world. Because **many animals navigate by following the Earth's magnetic fields, the rise in EMFs can disrupt their innate navigating abilities**. This is as problematic for **bees** seeking their way back to the hive after foraging for pollen (as I discussed earlier) as it is for migrating **birds**, (69) **wood mice** trying to remember where they made their nests, (70) and even **lobsters** traversing the ocean floor (71).

EMFs have also been implicated in reducing the number of tadpoles that grow into frogs (72) the **amount of milk produced by dairy cows**, (73) and the **areas where bats willingly fly**, (74).

So, the good news is that when you make efforts to protect yourself from EMFs, you are also helping the environment. But to make an even more dramatic impact, you will need to play an activist role and participate in movements to limit the spread of EMFs. I hope that thinking of the current and future health of our children will help motivate you to get into action.

THE POPULATION MOST VULNERABLE TO EMF DAMAGE

P 109. As dangerous as EMFs are to adults, plants, bees, microbes, and animals, they pose a **dramatically greater health risk for children**, primarily because of the duration of exposure. The youth of today will be exposed to EMFs for a much longer time than adults. As a result, the **opportunity for them to experience greater mitochondrial damage over time is exponentially higher**.

Children under 12 years of age also have higher body water content than adults, which allows them to absorb considerably more radiation. Additionally, **a child's bone marrow absorbs 10 times more wireless frequency radiation than an adults**. (75 and 76. Morgan IL, Kesari S, Davis DL. "Why Children Absorb More Microwave Radiation Than Adults: The Consequences." Journal of Microscopy and Ultrastructure. Vol. 2. no 4. (December 2014): 197-204. Doi: 10.1016/j.jmau.2014.06.005.)

Perhaps their biggest vulnerability, however, is all in their head.

CHILDREN'S BRAINS ARE PARTICULARLY AT RISK OF DAMAGE

There are no two ways about it: **EMF radiation from cell phones penetrates more deeply into kids' brains than it does into those of adults**. There are several reasons for this:

- Children's skulls are thinner than adults' skulls, which means more radiation is able to penetrate this protective barrier.
- Children have smaller heads in general, meaning there is less distance for radiation to travel in order to penetrate more deeply into the brain.
- Children's brains are still developing; they aren't fully myelinated yet, which means they have more water and less fat than adults and are more susceptible to radiation absorption.
- Their ears are smaller, and since the ear acts as a buffer between a cell phone and the skull, this means when children use cell phones the devices are closer to their skulls than when adults use them.

P 110. It's important to take precautions now to protect your children, especially because the damage done by EMF radiation can take years, and sometimes decades, to develop.

Gandhi's research not only highlights the heightened risks to children, but also the negligence of America's safety guidelines for radiation exposure, which are based on the specific absorption rate (SAR) of a 220-pound, six-foot-two male.

EXPOSURE STARTS IN UTERO

Depending on the habits of their parents, especially their mothers, many children are affected by exposure to radiation from EMFs when they are still in the womb - from their mother's use of laptops, cell phones, tablets, or cordless phones, or simply as a result of their mother's daily lifestyle.

While there is no reliable way to predict the long-term effects on children who are exposed while still in utero, one study involving more than 13,000 mothers revealed some sobering potential effects. As compared to children born of mothers who did not use cell phones during pregnancy, children born of mothers who did experienced a

- 49 percent increase in behavioural problems,
- 35 percent increase in hyper-activity,
- 34 percent increase in peer-related problems, and
- 25 percent increase in emotional issues. 82

Two Danish studies have documented an association between cell phone use in the mother and ADHD in children. In looking at two different groups - one made up of more than 13,000 children, the other of nearly 29,000 children - researchers found that if a mother talked on a cell phone while pregnant, her child would go on to have a 50 percent higher risk of ADHD. And if the mother kept the cell phone on continuously, that increased risk was 100 percent higher. (83,84)

Human studies also have found a link between the use of cell phones by pregnant mothers and higher rates of obesity (84) asthma (85) and yes, behavioural and attention challenges. (87)

It's not just cell phone radiation that poses a risk: it's all EMFs; Researchers at Kaiser Permanente in California have conducted multiple studies in which they have asked pregnant women to carry meters that measured their magnetic field exposure for 24 hours during their pregnancy, and then followed the birth outcomes as well as the babies for as long as 13 years.

They have found that women with higher exposures have 2.72 times the risk of miscarrying, (88) and their babies had a higher risk of having asthma, being obese, and suffering from thyroid problems. (89-91)

If you are pregnant or plan to become so in the future, please be certain to limit your exposure to EMFs, especially your cell phone, and magnetic fields - both for your own health and the health of your baby. Visit the website babysafeproject.org for specific guidelines on protecting your baby from EMFs.

See also: [The Dark Side of Prenatal Ultrasound and the Dangers of Non-Ionizing Radiation: Part 1](#) Paperback – 4 April 2019 by [Jeanice Barcelo](#) (Author)

A LINK BETWEEN EMF RADIATION AND ADHD?

P 112. A 2010 German study followed children who wore a radiation meter for 24 hours; those who had the highest levels of exposure had an increased risk of displaying more boisterous and uncontrollable behaviour, similar to that displayed by kids who have been diagnosed with ADHD (92)

In fact, ADHD shares many symptoms with electro-hypersensitivity, including: • Memory loss • Brain fog • Difficulty focusing • Blunted learning abilities

The Kaiser Permanente researchers I referenced in the previous section also found that babies born to mothers with higher magnetic field exposure during pregnancy also had 2.9 times the risk of developing a neurodevelopmental disorder such as ADHD. (93)

EMFS AND INCREASED AUTISM RISK

P 114. As further clues point to a link between autism and EMFs, many health-care practitioners report placing their young patients with autism on a low-EMF-exposure program (turning Wi-Fi off at night, unplugging cordless phones and baby monitors, and even turning off the circuit breaker to the bedroom) resulted in dramatic improvements in behaviour. (124)

It turned out the average exposure of an autistic child to high-frequency EMFs from household currents and microwaves from cell phones and other wireless technologies was 20 times that of the non-autistic children. Unfortunately, the study never made it into publication, but it convinced him that EMFs were an unacknowledged factor that contributes to autism. (125)

The real-world impact of EMFs is also evident in Klinghardt's clinical practice, as families with autistic children who take EMF remediation seriously report significant improvements in their children's behaviour, while those who fail to take steps to reduce EMF exposure fail to notice improvements.

EMOTIONAL EFFECTS OF EMFS ON CHILDREN

Cell phones, wireless-enabled tablets, laptops, and BlueTooth devices affect kids emotionally, and it starts when they are very young.

P 116. As reported in a 2018 New York Times article: The social scientist Sherry Turkle analysed 30 years of family interactions in her book [Alone Together: Why We Expect More From Technology and Less From Each Other](#). She found that children now compete with their parents' devices for attention, resulting in a generation afraid of the spontaneity of a phone call or face-to-face interaction. Eye contact now seems to be optional, Dr Turkle suggests, and sensory overload can often mean our feelings are constantly anesthetized. (126)

A Common Sense Media survey found that 25 percent of American parents say they fight with their child every day about phone usage.127

That same survey also reports that 29 percent of kids keep their phones in bed with them; worse yet, 36 percent of teens wake up to check their phones in the middle of the night.

This has a strong connection to mental health, as the blue light and radiofrequencies emitted from the phone as well as the mental stimulation of responding to notifications interrupts their sleep, reducing the length of time spent asleep as well as the quality of that sleep. **Without sleep, the body can't restore itself properly**, and this shows up in many factors of health, including mental health.

P 117. In 2017, San Diego State University psychology professor Jean Twenge published a study in *Clinical Psychological Science* for which teens in 8th through 12th grades were surveyed and compared those results to national statistics on adolescent depressive symptoms and suicide rates.

On screens were 35 percent more likely to have a risk factor for suicide than those who spent one hour or less. **When teens spent five or more hours a day on their phones, that risk increased by 71 percent.** (129)

And **suicide among young people is rising precipitously**. According to the CDC, the suicide rate among males 15-24 rose nearly 20 percent between 2000 and 2016. For females, it's worse: In that same time period, suicide among girls ages 10-14 skyrocketed 183 percent, and for 15- to 24-year-olds, the increase was 80 percent. (130)

APPLE CHANGED ITS SCREEN TIME GUIDELINES FOR CHILDREN

SOME COUNTRIES RECOGNIZE THE RISK

The evidence makes it abundantly clear that EMF exposure is a significant health hazard for today's youth. **Schools need to take a step back and begin to implement strategies to protect students while in the classroom, such as eliminating Wi-Fi and converting to wired connections. Parents also need to establish firm guidelines around children's use of technology.**

As noted by Devra Davis, Ph.D., an epidemiologist and author of the book, *'Disconnect: The Truth about Cell Phone Radiation, What the Industry Is Doing to Hide It, and How to Protect Your Family'*, children have never before been exposed to this level of pulsed radiation, and it's still too early to determine the exact extent of harm. Still, mounting evidence suggests damage is indeed occurring, so it would be foolish to wait to respond until we're in the midst of a global catastrophe.

CHAPTER 5: EMFS AND DISEASE

RINGING IN YOUR EARS (TINNITUS)

Interestingly, **humming or ringing in the ears is one of the most common symptoms of those who are impaired by or suffer with EMF hypersensitivity.**¹

Ears appear to be highly susceptible to the influence of EMFs, and thus they can be early indicators of EMF damage - sort of the canary in the coalmine.

A pair of identical studies in Goteborg, Sweden, done nine years apart showed that **tinnitus is increasing dramatically in young children**. In 1997 just 12 percent of the seven-year-old schoolchildren studied had tinnitus. (9) **In 2006, 42 percent of seven-year-old schoolchildren had tinnitus.** (10)

CATARACTS

They are some of the most well-documented ailments linked to EMF exposure.

In 2008, Israeli researchers set out to assess the effects of 1.1 GHz radiation on the eye. They observed two types of damage in the lens: a reduction in **optical quality** of the lens, which was reversible, and structural and biochemical **damage** to the epithelial cell layer of the lens that was irreversible. (11)

DISRUPTION TO YOUR BLOOD-BRAIN BARRIER

The increased oxidative stress triggered by EMFs and peroxynitrite production can cause an **increased permeability in your BBB**. When your BBB is damaged in this way it can contribute to a wide variety of problems, including cancer and neurodegenerative processes like Alzheimer's disease. (13)

For more specific details of how our knowledge of the impact of EMFs on the blood-brain barrier has evolved, you can review the [BBB section of the BioInitiative Report](#), which I referenced in Chapter 4 as a comprehensive review of the science on the physiological effects of EMFs, as it contains a very detailed analysis and explanation as to precisely how EMFs impact your blood-brain barrier»

IMPAIRED SLEEP AND REDUCED MELATONIN

One of the most common symptoms reported by people who are experiencing a new EMF exposure is insomnia.

EMFs reduce melatonin levels. Melatonin is a hormone primarily produced in your pineal gland, which is essential for establishing a healthy circadian rhythm.

The importance of sleep to your health, I strongly recommend reviewing UC Berkeley professor Matthew Walker's book *Why We Sleep: The New Science of Sleep and Dreams*. (22)

In addition to optimizing your circadian rhythm, melatonin has powerful antioxidant properties, helping to suppress excessive harmful **free radicals** and reduce markers of brain aging and degeneration.

EMFs ALSO DISRUPT YOUR INTESTINAL BARRIER

Similar to how **EMFs** degrade your BBB, they **also weaken the integrity of another important barrier, your intestine**. EMFs weaken the tight junctions between the cells that line your intestinal tract, creating a condition known as **leaky gut**.

While a leaky gut is primarily associated with inflammatory bowel diseases such as Crohn's and ulcerative colitis, healthy people can also have varying degrees of increased intestinal permeability, which can lead to a wide variety of symptoms.

Once the integrity of your intestinal lining is compromised, **toxins and foreign proteins can enter your bloodstream. This results in many problems, including an increase in inflammation**. Chronic inflammation can also contribute and/or lead to other health conditions such as arthritis and heart disease.

This compromise in your intestinal barrier may also cause your immune system to become confused and begin to attack your own body as if it were an enemy, which is a hallmark of autoimmune disorders.

As Dietrich Klinghardt puts it, **the human microbiome is “hugely and directly damaged by the electromagnetic waves we’re exposing them to.”**

INCREASED TOXIN ABSORPTION

When EMFs increase the permeability of your BBB, toxins are allowed easy access to your brain. This results in an increased **toxic load in your brain**.

Another way EMFs can contribute to your overall toxic load is if you have any “silver” or **mercury amalgam fillings**. EMFs have been shown to significantly increase the amount of mercury leaching from any metal fillings you have in your teeth. (26)

CANCER

One of the probable links between EMFs and cancer is the increase in oxidative stress; that contributes to mitochondrial dysfunction that is a major cause of DNA damage and cancer. There are a few types of cancer that currently have a stronger scientific connection to EMFs than others.

Brain Cancer

If you would like to examine the evidence more thoroughly you can consult the [BioInitiative Report I](#) introduced in Chapter 4, which has compiled hundreds of studies in four PDFs on the use of wireless phones and the evidence for an increase in brain cancers. (34)

A Swede Lennart Hardell found that **anyone who began using a cell phone at an age younger than 20 had the highest risk of developing glioma** (42)

Hardell also published subsequent studies strengthening the link between cell phone and cordless phone usage and brain tumours. They found that tumours were most likely to form in the area of the brain closest to where a cell phone rests while on a call, and that **risks of developing malignant brain tumours spiked in association with three risk factors: number of years of use, total number of hours of use, and age at first use**. (43,44)

A doubling in the incidence of glioblastoma tumours in England was documented in a 2018 paper published in the Journal of Environmental and Public Health. (45) The increase in malignant tumours was overwhelmingly found in the front and temporal regions of the brain, precisely where a cell phone is held during a call.

Breast Cancer

Breast cancer is one of the other common cancers associated with cell phone use. The [BioInitiative Report](#) has compiled nearly 50 studies providing evidence that EMFs can promote breast cancer. (46)

In addition, there is evidence linking breast cancer to exposure to extremely low frequency (ELF) EMFs, such as those emitted by power lines and electrical wiring. A 2016 meta-analysis of 42 studies that included more than 13,000 women with cases of breast cancer found that exposure to **ELF EMFs**

is associated with breast cancer, especially in the United States. (52)

Childhood Leukemia

Sadly, there is a well-established link between ELF/EMF exposures and childhood leukemia, the most common cancer in children.

The BioInitiative Report has compiled nearly 100 studies providing evidence of the link between EMF exposure and childhood leukaemia. (55)

HEART DISEASE

Your heart has one of the highest densities of voltage-gated calcium channels (VGCCs) and as a result is highly sensitive to EMFs, especially the pacemaker cells of your heart. This may be why EMFs tend to trigger the following heart conditions.

Cardiac arrhythmias: Martin Pall believes that the rising rates of sudden cardiac death could very well be related to the increase of EMF exposure as a result of excessive (VGCC) activation. 62,63

Blood pressure: When you consider that medication to reduce high blood pressure has been linked to a significantly increased risk of developing skin cancer in a 2017 study published in The Journal of the American Association of Dermatology (66) - and this medication might be less needed if EMF exposure were reduced - you will hopefully be even more open to the idea of reducing blood pressure via EMF remediation.

P 136. NEUROPSYCHIATRIC ILLNESSES

Another vital part of your body that has a high density of VGCCs and thus a significant vulnerability to EMFs is your brain causing mental health challenges, which have become pervasive and epidemic, such as anxiety, depression, hostility, impair memory (75) and difficulty concentrating.

EMFS AND THE MECHANISMS OF MOOD

Once you know that EMFs may over-activate your VGCCs, it's no surprise that exposure can affect your cognition and mental health. Martin Pall wrote in his review of studies found a demonstrable link between EMFs and neuropsychiatric effects

'VGCC activation has been shown to have a universal or near universal role in the release of neurotransmitters in the brain and also in the release of hormones by neuroendocrine cells.' (76,77).

Neurotransmitters, such as dopamine, serotonin, and norepinephrine, are the chemical messengers that keep your mind and mood running smoothly. If their delicate balance is upset - which is highly likely when your VGCCs are artificially activated by the presence of EMFs - it becomes more difficult to steady yourself when you have anxious thoughts, or to get a good night's sleep that helps to clear your head, or to focus on a task. Anxiety and depression can settle in as a "normal" way of feeling.

EMFs also suppress melatonin, and this important neurotransmitter and antioxidant plays a key role in mental health too, as low levels of melatonin have been shown to be related to a greater likelihood of depression. (78)

The earliest of these findings were in a 1971 research report by the [Naval Medical Research Institute](#)

that listed **40 neuropsychiatric changes produced by EMF exposure**. (81) Ten years later researcher Jeremy K. Raines was contracted by NASA to document known biological effects of EMFs on humans. His report reviewed extensive literature based on occupational exposures to microwave EMFs and found **19 neuropsychiatric effects** associated with microwave frequency EMFs. (82)

Other common neuropsychiatric illnesses are:

- Sleep disturbance/insomnia, headaches, Fatigue/tiredness
- Dysesthesia (vision/hearing/olfactory dysfunction) ,
- Concentration/attention/cognitive dysfunction
- Dizziness/vertigo
- Memory changes
- Restlessness/tension/anxiety/stress/agitation/feeling of discomfort
- Irritability

NEURODEGENERATIVE DISEASES

Indeed, studies dating back to the 1950s and '60s from the Soviet Union and the West (which were reviewed in a seminal 1973 papers 85) show that the **nervous system is the tissue that is most sensitive to EMFs**. Some of these studies show massive changes in the structure of neurons, brain cell death, and synaptic dysfunction. (86)

Many studies have found that occupations with high EMF exposures-including seamstresses, hairdressers, utility workers, and welders - are associated with an increased likelihood of developing a neurodegenerative disease, such as Alzheimer's, Parkinson's, or amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease. (87)

Research that analyzed mortality and census data on nearly 5 million residents of Switzerland found an **association between living within 50 meters of power lines and an increased risk of developing Alzheimer's**, and the risk rose significantly for every five years spent living in close proximity.(88)

ACCELERATES AGING

P 140. EMF exposure and the, secondary cellular stress it creates can increase the number of senescent cells in your body.(91) Senescent cells are merely aged and senile cells that have stopped reproducing.

Senescence has its benefits: It plays a role in tumour suppression, wound healing, and tissue regeneration. As we age, however, senescent cells take on a less beneficial role as they accumulate in tissues and secrete numerous pro-inflammatory mediators.(92) **Avoiding EMFs and avoiding excessive body fat are the two best ways you can limit the accumulation of senescent cells as you age.**

ELECTROMAGNETIC HYPERSENSITIVITY SYNDROME

These symptoms include: • Disrupted sleep • Confusion/poor concentration and/or memory loss • Headaches • Fatigue and muscle weakness • Cardiac arrhythmia • Skin itch/rash/flushing/burning and/or tingling • Tinnitus • Panic attacks, Dizziness • Ear pain • Paralysis • Seizures • Irritability, even hostility • Feeling a vibration in the body.

Often, those suffering from EHS will also be highly sensitive to chemicals or have MCS.(95) This

makes logical sense since your nervous system is a primary site impacted by both chemicals and electromagnetic fields, and if your nervous system has been **damaged from toxic exposures** like organo-phosphate pesticides, it may render you more susceptible to EHS as well.

Dr Omura, shows that **the more your system is contaminated with heavy metals due to things like having silver amalgam fillings, eating contaminated fish, living downstream from coal-burning power plants, and so forth, the more your body becomes a virtual antenna that concentrates radiation, making it far more destructive.** (98)

Other groups at risk for developing EHS include those with: • Spinal cord damage, whiplash, brain damage, or concussion • Impaired immune function, lupus, or chronic fatigue syndrome (CFS) • Bacterial and/or parasitic infections such as Lyme disease • Electromagnetic, physical, chemical, and biological trauma as well as impaired immune system • The very young and the very old. In children, EHS most typically presents as **headaches, brain fog, and difficulty learning.** • Tinnitus. **Evidence actually hints at a shared pathophysiology between EHS and tinnitus.** (99)

P 144. In one sense, people with EHS have an advantage, as the distinct discomfort that exposure to EMF causes strongly motivates them to take proactive steps to avoid exposures, as everyone else remains oblivious while still incurring biologic damage. **Whether you feel it or not, damage is occurring.**

INFERTILITY

There are estimated to be at least 48 million couples worldwide who are infertile, (103) which is approximately 7 percent of all men and women. (104) In couples who are having problems conceiving, approximately 40 percent of the issues are due to male impairments, while the remaining 60 percent is the result of fertility issues in the women. (105)

Men are facing a worsening trend of factors that contribute to infertility, particularly **lower sperm counts, lower sperm motility, and sperm that have irregular shapes.** This is likely because a man's genitals have a very high density of VGCCs, and **men tend to keep their cell phones clipped to their waistband or in their pants pockets, very close to the genitals.** It's a double whammy of exposure.

1986, was when the first study investigating the impact of electric blankets on fertility potential was conducted. There was a significant decline in sperm quality from 1940 to date has been well documented. (107)

While there are undoubtedly many factors at play, including increasing toxic chemical exposures through pesticide use and air pollution, it is also clear that EMFs are playing a major role in the loss of male fertility.

Studies have established that exposure to wireless radiation reduces sperm motility, (109) total sperm count, (110) viability (111) and quality (112) as well as increasing oxidative stress leading to infertility. (113) It appears that EMFs impair mitochondrial function of the eggs and sperm thus impairing fertility. (115)

Interestingly, EMFs have been shown to decrease fertility in rats by **lowering their testosterone levels.** Women's fertility is also susceptible to EMF exposure, in part because **EMFs disrupt the delicate balance of a woman's reproductive hormones.** This is supported by a 2008 study of women who were exposed to EMFs on the job - just as you likely are. Researchers found that the women experienced reduced progesterone levels and significant disruptions in their menstrual cycles,

including heavy bleeding. (119)

Thought to impair female fertility free radicals from oxidative stress can damage tissues, including oocytes (which are immature eggs) and embryos. (120)

Two studies showed that the EMFs from living within 100 yards of a cell phone tower **raise salivary levels of alpha-amylase, an enzyme that is released as part of the stress response**. (122) Women with high levels of alpha-amylase have been found to have a nearly one-third lower chance of getting pregnant than women with the lowest levels. (123)

Not only is it harder to get pregnant when you are exposed to EMFs, but the risk of having a miscarriage also increases. A 2017 Kaiser Permanente study followed 913 **pregnant women; those who were exposed to higher levels of EMFs had a nearly three times higher risk of miscarrying** than those with lower exposures (124) confirming the findings of previous similar studies. (125)

If the reduction in fertility rates as a result of EMF exposure continues to increase, as it very well could with the introduction of the 5G experiment, **EMFs could serve as a potent existential threat to the very existence of our species**.

Not only will **we** have an impaired ability to reproduce, but the **children conceived at this time** will face the very real, vastly unknown risk of the illnesses outlined in this chapter, as well as autism (as I discussed in Chapter 4), making it tremendously challenging to have a functioning society.

Although EMFs do appear to be playing a clear role in many diseases and conditions, it is possible to protect yourself. In the next chapter, you'll learn how to repair the cellular damage that EMFs can inflict so that you can prevent these diseases from occurring or aid your body in mitigating these diseases if you already have one or more of them.

CHAPTER 6: HOW DO YOU REPAIR EMF-RELATED DAMAGE?

P 149. Now that we have established how EMF exposure can damage your DNA through the peroxynitrite induced creation of free radicals, we have a framework to remediate the damage.

Although there is no way your ancestral biology could have predicted the enormous exposure you would have to MHz and GHz radiation from the wireless industry, you do indeed have a built-in repair system that can at least partially remediate the damage. It is called the poly (ADP-ribose) polymerase (PARP) family of enzymes. PARP1 is the most common in the family of 17 PARP enzymes and is best known for its ability to repair DNA damage.

Note that in 2019 the PARP1 name was changed to ADP ribosyltransferase diphtheria toxin-like 1 (ARTD1). (1) PARP enzymes function as DNA damage sensors and signalling molecules. These enzymes bind to both single- and double-stranded DNA breaks. (2)

Once these enzymes bind to damaged DNA, they form a matrix of long branches of ADP-ribose polymers. (3) This matrix of ribose polymers created by PARP then allows different specific DNA repair enzymes to come in and repair the DNA damage.

This process does come with a few downsides, however. The biggest one is that PARP requires fuel to work, and that fuel is one of the most important coenzymes in your body: **nicotinamide adenine dinucleotide, or NAD+** for short.

You will get to know NAD+ better in a bit, but for now let's dive into how EMF exposure can lead to an inability to fuel PARP repair, and why this is one of the most important negative consequences of EMF exposure.

PARP enzymes are voracious consumers of NAD+. Every time you have a DNA break, PARP actually sucks ADP molecules from NAD+ to form long branches of polymers that create the matrix for the DNA repair enzymes to work. (4) PARP uses as much as 100 to 150 molecules of NAD+ for every DNA repair it facilitates.

Moderate levels of PARP formation facilitate efficient DNA repair and prevent the proliferation of abnormal cells that could lead to cancer. (5) A moderate degree of cell damage can be managed by PARP without overly depleting NAD+ and the energy molecule adenosine triphosphate (ATP). However, exposure to severe DNA stress eats up so much NAD+ that cell death can result. (6,7)

EMF exposure can cause your cells to become NAD+ depleted. PARP is ordinarily the largest consumer of NAD+ in your body, and if you have a large EMF exposure you can radically reduce your NAD+ levels. And when your cells become NAD+ depleted, it also impacts your mitochondria by lowering an NAD coenzyme called NADH, which is necessary for your mitochondria to produce ATP.

Another consequence of PARP sucking up most of your NAD+ is that it depletes the supply for other vital longevity proteins, called sirtuins, that require NAD+ to function. (8,9) If PARP is consuming most of your NAD+, your sirtuins will not have enough NAD+ to run and your aging will be accelerated dramatically.

There is also one other downside to PARP: When it is called to repair your damaged DNA it also activates proinflammatory pathways that will increase your risk for virtually every chronic disease. (10)

So while PARP is a powerful DNA repair mechanism, and thus an important line of defence against EMF exposure, you need to keep your NAD+ levels high in order to fuel it, and prime your body's ability to use antioxidants to fight inflammation. Let's look at how to do just that.

THE HISTORY OF NICOTINAMIDE ADENINE DINUCLEOTIDE

Since its discovery, NAD+ has been established as an important coenzyme involved in the energy-production process that occurs in your mitochondria known as *oxidative phosphorylation*.

P 152. This was largely a result of work at the Massachusetts Institute of Technology around 2000 demonstrating that the sirtuin proteins, which play a role in cellular health and longevity, required NAD+ to function;(13) this heralded a whole new era in NAD+ research. (14)

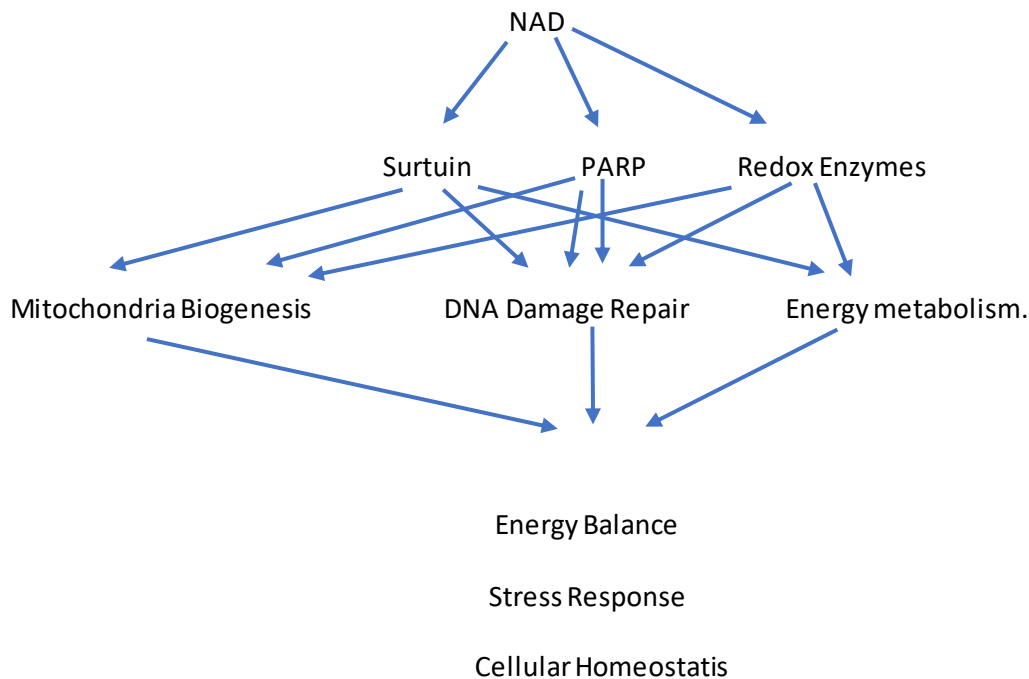
SOME OF THE MOST IMPORTANT MOLECULES IN YOUR BODY

NAD+ is a coenzyme, part of the NAD family of coenzymes, which also includes NADH, NADP+, and NADPH. (**NADH** = Nicotinamide Adenine Dinucleotide + Hydrogen; **NADP+** = Nicotinamide Adenine Dinucleotide Phosphate; **NADPH** = Nicotinamide Adenine Dinucleotide Phosphate Hydrogen).

Coenzymes are small molecules that cannot by themselves catalyse a reaction. Rather, they bind with an enzyme and enable that enzyme to trigger a reaction. NAD coenzymes are central regulators of metabolism and thus probably some of the most important and necessary molecules in your body.

They are indispensable cofactors in more than 700 enzymatic redox reactions central to most metabolic processes in your body, including burning fuel in your mitochondria to generate ATP, making glucose, fats, DNA, RNA, and steroid hormones, and support detoxification of free radical species. (15, 16, 17, 18)

What is common to all these molecules is that they all contain adenosine monophosphate (AMP), which is the precursor of ATP, the energy currency of your cells. For the sake of our focus on remediating the physiological damage caused by EMF exposure, we'll focus on NAD⁺ and NADPH



Redox means oxidation or removal of hydrogen.

What has recently been appreciated is that the ratio of NAD⁺ to NADH inside your cells may be one of the key metrics to determine how healthy you are. **High levels of NAD⁺ and NADPH are essential for maintaining cellular health.** Decreased levels of these valuable molecules have been linked to a variety of conditions such as cardiovascular disease, cancer, aging, (19) traumatic brain injury-induced inflammation, (20) seizure disorders, and neurodegenerative diseases. (21)

P 154. OTHER NAD COENZYMES

In addition to helping your body produce energy, **NAD coenzymes are necessary for your genes to be optimally expressed and for your immune and detoxification systems to function properly.**

They help recharge your body's antioxidants, in a process I'll explain in just a bit, so you can lower free radical damage. And, perhaps most important, they are essential to slow down the aging process (22) and radically reduce your risk of chronic degenerative diseases and increased frailty.

NADK is the enzyme that attaches a phosphate group to NAD⁺ and NADH to form NADPH, which we'll discuss next. (23)

NADPH: THE BATTERY OF YOUR CELL

NADPH provides a reservoir of electrons and can thus be thought of as a stable form of storage of electronic-reducing potential. In simpler terms, NADPH is your cell's battery. (24) Yes folks, **NADPH is the true battery of your cell - not your mitochondria, as some people believe.**

NADPH is involved in keeping your antioxidants in tip-top shape by regularly supplying them with electrons so they can do their job and lower damage from oxidative stress. (25)

It does this by using its electrons (from hydrogen, the "H" in NADPH) to recharge your body's antioxidants like glutathione and vitamin C. (26) and convert them to their active functional forms. (27)

ANTIOXIDANTS WITHOUT NADPH AREN'T AS HELPFUL AS YOU MIGHT THINK

After the free radical theory of aging was initially proposed by gerontologist Denham Harman (28) in the 1950s, supplementing with antioxidants became a popular strategy to slow down the aging process. There is an overwhelming amount of evidence showing that this is likely not a wise strategy, (29) In recent years it has been shown that taking antioxidant supplements, such as vitamins C (30) or E, (31) does not extend lifespan.

The main problem is that antioxidants like vitamins E and C and glutathione are charged molecules, and because of their charge they do not readily cross your cell membranes and enter your cells. This is why you want to leverage NADPH levels to recharge the antioxidants already in your cells.

Antioxidants work by donating an electron to neutralize free radicals. Once they donate that electron they become useless or, even worse, actually start to function as pro-oxidants. To work as antioxidants again they need to be recharged.

NADPH is what recharges your antioxidants to their active forms. Without NADPH, antioxidants aren't all that helpful. In fact, research has shown that antioxidants provide little longevity benefit in elderly people whose NADPH levels have declined to such an extent to prevent their efficient recycling. (32)

HOW TO INCREASE YOUR NADPH LEVELS

P 156.

- ***Reduce Your EMF Exposure***

Minimizing Your EMF exposure can radically increase your NAD⁺ levels, because when you are exposed to EMFs and your DNA strands break, PARP uses 150-200 molecules of NAD⁺ in an effort to repair that damage.

- ***Avoid eating at least 3-4 hours before you go to sleep***

This allows your body to activate the powerful process of autophagy that recycles your damaged cellular parts. On many days I only eat within a four-hour window.

The largest consumers of NADPH are the enzymes used for converting excess calories you eat to store them as fat. (34) If you eat a large meal close to your bedtime there is simply no way for your

body to burn those calories as energy, so it must store the calories by creating fat.

This process consumes enormous amounts of NADPH. With Your NADPH levels lowered this way, you will be unable to keep your antioxidants optimally recharged while you sleep. As a result, you will have far more oxidative damage from the free radicals that cannot be neutralized (due to low NADPH levels) than if you had eaten those calories earlier in the day.

- ***Inhibit NADPH Oxidase***

The enzyme **NADPH oxidase (NOX)** is another major consumer of NADPH. It has many roles including **supplying your white blood cells with the ability to destroy invading pathogens**, cellular signalling, and the regulation of gene expression. (35) NOX in your blood vessels also generates reactive oxygen species (ROS), important for maintaining normal blood pressure. (36)

One of the other rarely discussed benefits of limiting EMF exposure is that it will also decrease NOX activation. The NOX enzymes don't work constantly, and they require a signal to cause them to turn on. Guess what that signal is? You are pretty sharp if guessed it is **increased calcium** coming into the cell (37), which is precisely what EMF exposure creates.

When you understand why calcium flooding into a cell activates NOX, you'll see how this process reinforces the EMF damage mechanism. Let me explain.

When NOX eliminates a viral or bacterial threat, it also increases superoxide in your white blood cells. This large localized production of superoxide will form a major way to trap nitric oxide produced by any cell in the region. The nitric oxide will then combine with superoxide to form peroxynitrite, which will form the highly reactive carbonate free radical to destroy the invading germs. (38)

Therefore, assuming you don't have a raging infection that needs to be battled with NOX by your white blood cells, you can increase NADPH by inhibiting excessive activation of NOX, and you can do that by limiting your EMF exposure.

You can also inhibit activation of NOX by using molecular hydrogen. Molecular hydrogen (H₂) is the lightest element and is the smallest molecule in the universe. It can easily penetrate your cell membranes and other subcellular structures.

It slows down the effects of excessive reactive oxygen species (ROS) and reactive nitrogen species (RNS) generated when you have a disease.

H₂ protects your DNA, RNA, proteins, cell membranes, and mitochondria from damage. (40)

In addition to lowering oxidative stress and inhibiting excessive NOX activation, it is also a potent stimulus of the Nrf2 pathway, which I will discuss in just a few pages. (41)

Interestingly, two human studies have shown that using hydrogen water helps mitigate side effects of radiation therapy in cancer patients. (45,46) Further studies on molecular hydrogen and its protection against radiation are in process, but more research is needed.

There are a wide variety of tablets out there, but you will want ones that have a concentration of **9 milligrams per liter, as they give you the most hydrogen.** You can find these in our online store at mercola.com as well as through other outlets. Once or twice a day in water seems ideal.

- ***Increase NAD+ Levels Directly***

When you increase your NAD+ levels with NAD+ precursors you can help to restore your body's ability to repair the damage from EMF exposure by fuelling the PARP enzymes. (47) Scientists have reported that NAD+ can also greatly reduce X-ray-induced radiation damage in tissues exposed to ionizing gamma radiation, (48) and that **NAD+ deficiency is a key factor in ionizing radiation-induced tissue injury**. (49)

7 Foods That Will Naturally Increase NAD+ and Restore Your Youth

<https://greatperformersacademy.com/health/7-foods-that-will-naturally-increase-nad-and-restore-your-youth>

This discovery is **NAD+. Nicotinamide Adenine Dinucleotide (NAD)** is a compound of chemical nature which is found in every single cell in our bodies. It is derived from Nicotinamide Riboside. Its levels in the body determine the speed of the aging process. More NAD+ results in younger cells, tissue and body overall. Here is how to naturally boost NAD+ and its contribution to the anti-aging process.

NAD+ facilitates the transfer of energy to our cells from the food we consume. This is done in a process known as oxidation. Under normal conditions, whenever our cells need to conduct some specific functions, they demand energy from the blood stream. This energy is found in the form of fatty acids and glucose. NAD+ performs the task of getting these energy sources from the blood to the cells which require it. This results in high levels of mental and physical energy. NAD+ is responsible for performing very important biological processes which are related to aging. These ones reverse the process of growing old by making body cells look and behave younger.

- ***Fish***

Known for its strong aroma and soft white meat, fish is consumed all over the world. Some varieties of fish have pretty high amounts of NAD+ in them. Examples of these are tuna, sardines and salmon. According to a nutritional study, tuna contains 20.5mg (milligrams) of NAD+ while salmon contains 10.1mg per cup of the chemical compound.

- ***Beer***

Beer is one of the most popular beverages in the world. Many people take it to celebrate or simply to relax after a long day at work. Studies have found that this beverage contains yeast. Hence, it is a source of NAD+. As such, responsible drinking can grant you the benefit of youth over time.

- ***The Crimini Mushroom***

Mushrooms are a popular type of food among various societies around the globe. They are cooked into a stew or made into a soup. They are some of the foods which contain NAD+. In every cup of Crimini Mushroom, you can get 3.3mg of NAD+.

- ***Chicken***

This well-known bird has some of the tastiest meat available today. You can get it grilled, roasted or stewed. Chicken meat is a good source of NAD+. It contains 9.1mg (milligrams) of this chemical compound. Therefore, never pass up a chance to eat some chicken. You can get younger with every

tasty bite.

- ***Yeast***

This is one of the most essential components in making bread and cakes. Yeast makes the dough rise. Interestingly, it contains Nicotinamide Riboside (NR). This is the precursor to NAD+. Hence, consuming pastries which have some yeast in it can contribute to growing younger. As a matter of fact, yeast actually contains more NAD+ per part than milk.

- ***Green vegetables***

Green vegetables are well known to contain all sorts of good nutrients. Now, they have been proven to contain the youth promoting NAD+ chemical compound. Peas and asparagus are some of the vegetables which have some amount of this chemical. They contain 3.2mg and 2mg of NAD+ per cup respectively.

- ***What to Eat to Increase NAD+ Levels Naturally***

<https://futurenowdetox.com/increase-nad-levels-with-diet/#>

- ***Whole Grain Breads and Cereals***

White rice, flour, and sugar are produced by taking raw materials and stripping them of all nutritional value. Rather than buying “fortified” versions of healthy grains, opt for whole-grain cereals and breads, brown rice, and eliminating sugar from your diet altogether.

- ***Eggs and Fortified Milk***

For some time, it was thought that eggs and dairy had a negative impact on health, especially for those trying to lower their cholesterol and prevent heart disease. Although any food can be unhealthy if you cook it in fat or eat too much of it, eggs contain other nutrients like choline that are essential for good nutrition. They also provide protein and vitamin B.

Opt for boiled or poached eggs and skim milk that’s fortified with vitamin D3.

- ***Fish***

Fish like salmon and cod are a great source of omega 3 fatty acids and lean protein. They’re also high in substances that contain NAD+. Eat them baked or steamed without added oil or butter.

- ***Crimini Mushrooms***

Most edible mushrooms contain **micronutrients** that support good health and reduce the effects of aging. Crimini mushrooms, in particular, are ideal for boosting NAD+ levels in your body. Each cup contains 3.3mg of NAD+, and they’re easy to add to meat dishes, soups, salads, rice, and omelets.

- ***Green Vegetables***

Green, leafy vegetables form the basis for many a diet plan, and with good reason. But, we’re

expanding on this slightly to include lentils, lima beans, peas, and asparagus. Each of these foods contain between 2 and 3.2mg of NAD per one-cup serving. They also have other health benefits that promote longevity.

- **Fermented Foods**

Foods that fall into this category include yeast, kimchi, and sauerkraut. There is something about the fermentation process that elevates NAD in these food products and reduces inflammation, bloating and other digestive issues. Kimchi and sauerkraut are great as side dishes, and yeast can be sprinkled onto cereal or mixed into smoothies.

* * *

P 160 The good news is that under normal conditions your body will recycle 99 percent of its NAD+, so you only need to replace roughly one percent, or about 90 milligrams. (50)

Please note that is under normal conditions.

Remember, PARP is one of the primary consumers of your NAD+. If you are under constant EMF stress and damaging your DNA, you will deplete your NAD+ far more than one percent, meaning your replacement levels could easily exceed that one percent by many times.

So, how do you go about replacing depleted NAD+?

There are two primary options.

The **first** is to make it from scratch, a process called de novo synthesis. This process typically uses the amino acid tryptophan (in bananas). Unfortunately, it is very inefficient; it takes about 70 milligrams of tryptophan to make 1 milligram of NAD+.

The **second** way to produce more NAD+ is to make it from what is called a salvage pathway, in which you recycle its breakdown product, **niacinamide**, and convert it back to NAD+. This process takes niacinamide through a series of enzyme reactions to re-create NAD+.

This is the way the vast majority of your NAD+ is replaced. Unfortunately, with modern EMF exposures and nearly continuous PARP depletion, this pathway is not nearly enough to keep up with your daily demand. You can, however, enhance this pathway and keep your NAD+ depletion and replacement in balance, as I will now explain.

How To Keep Your Nad+ Levels High

Another factor that can diminish your NAD+ levels is simply getting older - as they decline quite dramatically with age.

P 162. It remains unclear why the breakdown and synthesis of NAD+ do not stay in balance as we grow older, but it appears that synthesis becomes outpaced by consumption, which is likely related to increased inflammation and excess oxidative stress that has been especially accelerated in the 21st century by PARP activation through EMF exposures. (52)

One of my friends, James Clement, is an NAD researcher and has mass spectrometry equipment in his lab that can accurately measure NAD+ levels. He wrote a landmark paper with the leading NAD

expert, Dr. Nady Braidy, in 2019 that was the most viewed article of the entire year in 'Rejuvenation Research' (53) It was an epic paper, as it was the first study to clearly document the radical and shocking decline in NAD+ levels that occur with aging. [[The Plasma NAD+ Metabolome Is Dysregulated in "Normal" Aging](#)]

Age of 30 were around 40 nanograms per millileter ng/ml in the blood. Levels dropped progressively as individuals reached the age of 80, to less than 1 ng/ml.

There were some exceptions, though, as one 85-year-old who exercised aggressively had a level of 9 ng/ml. This is likely due to the fact that exercise is one way to activate the rate-limiting enzyme for NAD+ formation, NAMPT, from its degradation product nicotinamide. **If you fail to exercise regularly as you age and grow old, not only will your NAD+ levels drop but your nicotinamide (NAD+ precursor) levels will rise;** high levels of nicotinamide, in tum, will inhibit the sirtuin longevity proteins. The older you are, the more aggressive the augmentation therapy needs to be.

If you are between 30 and 40 years old, or even younger, you need to do very little other than to make sure you are implementing the NAD+ basics that nearly everyone needs, such as:

- Getting enough **niacin** every day (around 25 milligrams - I explain more in the next section).
- Doing regular bouts of high-intensity exercise, as this will increase NAMPT and secondarily NAD+. Aerobic and resistance exercise training reverses the age dependent decline in NAD+, as both forms of exercise increase NAMPT.

The most exciting exercise development is the use of **Blood Flow Restriction Training** that allows the use of low weights and high repetitions to produce incredible metabolic benefits, including NAMPT activation.

It is my absolute favourite way to increase NAD+. Not only will it increase NAD+ but it will also prevent and treat sarcopenia, or age-related muscle loss, and osteoporosis. It will also help prevent heart attacks and strokes. It requires a full chapter to explain. As such, it is beyond the scope of this book, which is why I have placed the material that you can access for free at BFR.mercola.com. (<https://media.mercola.com/assets/pdf/ebook/blood-flow-restriction-ebook.pdf>) [Video: Dr. Mercola explains the science behind Blood Flow Restriction training: <https://www.youtube.com/watch?v=KP40-496-N8&feature=youtu.be> - NAD discussed at minute 21.30]

- Implementing time-restricted eating also increases NAD+.
- Having your last food at least three to four hours before you go to sleep. If you eat closer to the time you sleep you will likely store most of the energy from that food as fat, a conversion process that requires NADPH. (54)

NIACIN THERAPY

P 164. Niacin is one of the precursors of NADPH.

Prior to food supplementation with niacin, people died from pellagra, a disease caused by a niacin deficiency whose hallmark symptoms are skin rashes, diarrhoea, mouth sores, and dementia, which at that time was endemic in the United States. (60,61) Niacin deficiency also has been shown to cause DNA damage and unstable chromosomes. (62,63,64 & 65)

Niacinamide

Another vitamin B precursor that can be used is niacinamide (also called nicotinamide).

Best Ways to Increase Your NAD+

- Make sure you are getting about 25 mg of niacin a day and have regular magnesium supplementation to reach at least your RDA of 400 mg of elemental magnesium

Increasing NAD+ Indirectly Through NQO1

There is an elegant enzyme that will actually convert NADH back to NAD+. That enzyme has a heck of a long, complicated biochemical name - **NADPH dehydrogenase, quinone 1**. Thankfully, we can call it NQO1 for short.

What is important for your health and longevity may not be the actual concentration or level of NAD+ in your cells, but rather the NAD+/NADH ratio.

But one of the other important ways to boost NQO1 is to activate a very important DNA transcription factor that you may not have heard of previously, the Nrf2 pathway, which I will describe next. This is also one of the pathways that molecular hydrogen activates.

NRF2 IS A KEY PATHWAY TO KEEP YOU HEALTHY

The Nrf2 pathway is the master regulator of responses to oxidative damage from free radicals, inflammation, and mitochondrial dysfunction. In addition to helping your body address the effects of EMFs, the Nrf2 pathway protects your cells from the damaging effects of ionizing radiation such as X-rays. (72,73)

Since its discovery, Nrf2 has become most known for its role in activating genes that have powerful antioxidant effects. (74) It does not indiscriminately suppress all free radicals; it is only called to action when your body needs to reduce free radical damage. At that point, it will trigger your DNA to activate up to 500 genes, including antioxidant proteins, and detoxifying enzymes. (75)

P 168. Nrf2 can activate the production of hundreds of antioxidant and stress-response genes. Some of these include the NQO1 gene we talked about earlier, glutathione peroxidase, thioredoxin, catalase, superoxide dismutase heme oxygenase-1, and many others. (82)

You will be pleased to know that Nrf2 also plays a major role in optimizing the entire family of NAD coenzymes. Not only does it increase NADPH, Nrf2 also activates NQO1. (83)

In addition, Nrf2 activates a total of 25 different detoxification genes, each of which produce an enzyme that acts in detoxification of various toxic chemicals. (84) This is very beneficial, because thanks to the industrialization of the 20th and 21st centuries, your exposure to chemical toxins has increased dramatically.

How Nrf2 Works

We believe that one of the general biologic strategies that enables Nrf2 to do its beneficial work is a process called hormesis.

Many of the polyphenols (primarily micronutrient found in plants that are antioxidants) that activate Nrf2 are actually produced by plants to ward off predators. These chemicals can kill predators in large doses but, when used in smaller increments, are quite beneficial.

Moderate stress causes a response in your body that is protective against future insults: Exercise and calorie restriction are two other examples of this principle. To be effective, though, the stress must be pulsed; it cannot be continuous or chronic. This is why pulsing many Nrf2 activators is so important. It just isn't a wise strategy to take most of them continuously.

Exercise, for example, puts stress on muscles that cause your body to react in ways that increase muscle strength. Weight-bearing exercise puts stress on your bones, causing your body to react by increasing bone strength. And we all know that you need to have recovery periods after exercise. For example, if you exercise continuously without rest, it could be very damaging and counterproductive to your health.

In this same way, after an oxidative stress-inducing incident, your body requires time to clear out oxidation by-products and re-establish homeostasis. Your cells also likely require time to replenish their stocks of Nrf2.

Nrf2 and Health Span

Many researchers believe that Nrf2 is a master regulator of not only longevity, but also, more important, of health span. (85) Whereas life span refers to the oldest age you reach, health span is the oldest age at which you maintain all the aspects of being healthy. It is not a victory to live to an old age if you are crippled with arthritis and pain, immobile, frail, and lacking most of your mental capacity.

Nrf2 may provide these benefits by facilitating the removal of senescent cells that have stopped reproducing and create silent inflammation. (86) Interestingly, when mice have their Nrf2 genes removed they develop premature cellular senescence. (87)

This makes perfect sense because one of the primary drivers for senescent cells is oxidative stress, and Nrf2 is magnificent for addressing this. (88) If you are older than 65, you will want to consider strategies to activate your Nrf2 pathways because you likely have diminished Nrf2 activation (89) in addition to lower NAD+ levels.

Also, it is well known that calorie restriction benefits your health primarily through activating **autophagy**, which comes from the Greek words for **self-eating**. It is a process that removes damaged and defective cellular parts, tags them for destruction, and then breaks down the cellular parts to their constituent elements so they can be recycled.

Nrf2 not only stimulates autophagy (90) but it is also likely responsible for many of the health benefits afforded by calorie restrictions. (91-95)

It just keeps on getting better with **Nrf2 benefits**, as researchers have found that this pathway also stimulates a process called **mitochondrial biogenesis**, which increases the number of your mitochondria and improves your mitochondrial function-essential for optimal health.(96,97)

Natural Products Activate Nrf2

Many studies have shown that the consumption of fruits and vegetables is associated with reduced

risk for cardiovascular disease and stroke. Experts used to believe that the protective effects of the **phytochemicals**, the protective chemicals that the plants produce, resulted from their direct **antioxidant** actions.

However, the understanding now is that the benefits conveyed by the phytonutrients in fruits and vegetables are likely largely related to their **Nrf2-stimulating** action and not their antioxidant action.

The Nrf2-boosting chemicals on the following list are mostly Polyphenols. (101-108)

- Vitamin D (109)
- Molecular hydrogen (110-112)
- Sulforaphane 113 from broccoli
- Rutin from apples, black and green tea, and buckwheat (114-116)
- Quercetin, found in capers, red onions, berries, and broccoli. (117-120)
- Curcumin (121-123) from turmeric
- Fisetin, which is found in strawberries, green tea, chamomile tea, and apples (124)
- Resveratrol, found in pistachios, grapes, blueberries, and dark chocolate (125-127)
- Green tea and its active ingredient epigallocatechin-3-gallate (EGCG)
- Apple peel polyphenols (131,132)
- Pomegranate peel polyphenols (133-135),
- Delta- and gamma-tocopherols (vitamin E) and tocotrienols (not alpha, which has little activity), from raspberries, blackberries, soybeans (which you should only eat organic versions of to avoid genetically modified organisms), hazelnuts, and olive Oil (136-139)
- Purple sweet potatoes (140-142)
- Astaxanthin (143-145) from microalgae and in some seafood, like krill
- Isothiocyanates from broccoli, cabbage, and other cruciferous foods (146,147)
- Triterpenoids and other terpenes, found in beans, apples, peppermint, oregano, and thyme (148,149)
- Sulphur compounds including allyl sulphides in garlic, onion, and allium foods such as chives and leeks (150,151)
- Carotenoids, particularly lycopene, which is found in tomatoes, watermelon, and guava (152,153)
- Fish oil (long-chain omega-3 fatty acids DHA and EPA) (154,155)
- Modest oxidative stress (hormesis), such as that induced by exercise (156)
- Melatonin (107)

While many consider daily consumption a useful protection strategy, I have some concerns that continuous use of the high dose concentrated versions available in many supplements may be counterproductive. That's why I recommend you prioritize getting these polyphenols from **whole foods**.

I also suspect the use of these high-dose polyphenols is more appropriate when you have autophagy ("self-eating") activated through fasting or partial fasting of at least 40 hours. In this scenario the polyphenols would likely improve the level and benefits of **autophagy**.

THIS COMMON MINERAL CAN ALSO HELP: MAGNESIUM

There is one more supplement strategy to address EMF damage that can be effective: **to block excessive calcium channel activation**. **Magnesium** can help with this. Magnesium is the fourth most abundant mineral in your body after calcium, potassium, and sodium. It activates more than 600 enzymes and is an important cofactor for the activation of a wide range of transporters and enzymes.

(158)

Magnesium is essential for the stability of cell function, RNA and DNA synthesis, and cell repair. Interestingly, magnesium is also a **natural calcium channel blocker**.

Magnesium has been used for some time for lowering blood pressure because it acts like a natural calcium channel blocker. (159) If you can prevent activation of the calcium channels by EMFs then you could decrease the need for repairing peroxynitrite damage.

Magnesium is inexpensive and virtually free of side effects. Because it is also a natural laxative, it has a built-in safety mechanism. If you take too much oral magnesium you will simply eliminate it by having loose stools.

Additionally, it is well documented that more than half of Americans do not take enough magnesium. A baseline for “enough” is approximately **400 milligrams of elemental magnesium per day**. (160) However, that is based on RDA (recommended daily allowance) values.

Types of magnesium.

- Citrate is also highly bioavailable and has an elemental magnesium level of 11.4 percent. The benefit of using this form is that the citrate will help bind oxalates (naturally occurring molecules in many plants that can cause kidney stones and other biologic damage) and prevent them from absorbing the magnesium and also help dissolve existing oxalate crystals you have accumulated in your body.
- Glycinate has a high amount of elemental magnesium at 14 percent.
- Threonate has a low amount of elemental magnesium at 8 percent. Its claim to fame is that it's particularly good at passing the blood-brain barrier and increasing magnesium levels in your brain. Once it gets into the brain, it increases the density of synapses, which are the communication connections between brain cells. (161)

EVEN BETTER THAN REPAIRING DAMAGE

Eat appropriately and avoid RFR as much as possible.

CHAPTER 7: HOW TO PROTECT YOURSELF FROM EMFS

P 177. The tactics I outline in this chapter are beneficial for everyone. If you are challenged with a serious illness, it is imperative that you reduce your exposure as much as possible, as EMFs will only worsen your health challenges. The most well-known professionals who offer this service are building biologists, trained and certified to analyze indoor environments and systematically **seek to reduce chemical, mould, electric, magnetic, and radio-frequency irritants**.

P 179. The most well-known professionals who offer this service are building biologists, trained and certified to analyze indoor environments and systematically seek to reduce chemical, mould, electric, magnetic, and radio-frequency irritants. They can also help you learn how to use your own meters and add to your knowledge of how to – determine, reduce, and eliminate EMFs that lurk in your home.

PRIORITY No. 1: REDUCE EXPOSURE TO EMFS WITHIN YOUR HOME

P 183. It's important to realize that your Ethernet connection net cable to get on the Internet, you

will still have high electric fields when you put your hands on the laptop. You are essentially swapping one type of EMF for another.

You can avoid high electric fields by using a **grounded Cat7 Ethernet cable (with metal ends)** and an **Ethernet grounding adapter kit** (see Resources for recommendations).

Take Control of Your Phone

I know this may sound challenging, but you also want to **avoid using a cell phone in your car, or while you're on a bus or train**, even when the connection to a cell tower is strong. Because you are in motion, the phone will need to work harder to stay in communication with the cell tower and again, will emit more radiation as a result.

Additionally, **because you are encased in metal, all that extra radiation reflects off the inside surfaces of the vehicle, thereby intensifying the radiation**. Better to keep your phone in airplane mode when you're in the car. If you commonly use it to listen to music or podcasts, download the content before you leave so that you can still enjoy it without being connected to a network.

Other Strategies

P 196. The other challenge with virtually every new smart TV is that it is impossible to disable the Wi-Fi. This means it will be regularly blasting you with Wi-Fi even when you don't have any Wi-Fi enabled on your router in your home.

Consider using a large high-resolution computer monitor as your TV instead, as it won't have this issue. They also typically have less flicker than a TV. The other benefit of watching your video on a computer monitor is that you can use software from a company like Iris (<https://iristech.co/>) that allow you to filter out blue light when you watch TV at night.

Sony brand smart TVs do allow you to disable the Wi-Fi. Plug an Ethernet cable into the Ethernet jack that all smart TVs have on the back. On other brands of smart TVs, **plug the TV's power cord into a power strip and flip off the power to the TV when you're not watching it**.

You really don't want to be within 100 feet of a **microwave** that is running, so it's best to **remove it from your home**.

P 198 **Avoid wearing metal-framed glasses**. Researchers have found that metal frames can, in certain cases, cause an increase in field levels by up to approximately 20 decibels (dB), which is about a **tenfold increase** over that seen without them: It would be best to switch to plastic frames for any glasses that you wear.

Refuse a smart utility meter on your home as long as you can. If your utility does not offer an opt-out program, **put a smart meter guard over your smart electric, water, and gas meter**. They are available from smartmetercovers.com and smartmeterguard.com.

Avoid electrical radiant floor heating systems, which emit both high magnetic and electric EMFs that can be measured even at waist height, unless you use a brand that neutralizes EMFs (see Resources). Ideally it is best to consider another heating solution.

Some electric beds, like hospital beds, also have a transformer mounted right up under the mattress, putting high magnetic fields into the middle part of your body all night long.

Ideally, it's **best to turn off the electricity to your bedroom altogether when you sleep.**

P 200. Even seemingly nonconductive objects in your room that are near walls can be energized and bring AC electric fields toward your body. Prior to the 20th century Your AC body voltage was zero. Now EMF remediation experts are finding that the average body voltage is anywhere between 500 and 3,000 millivolts, or 0.5 and 3 volts. In homes wired with knob and tube wiring in the 1920s and '30s, it can be as high as 12,000 millivolts.

So, what happens when you are surrounded by electricity at night and your body voltage is upward of 3,000 millivolts? **This energy causes muscle micro-contractions that can deplete your mineral stores and increase your cortisol, which in turn lowers your melatonin at night while you're sleeping.** Electric fields essentially rob you of a good night's sleep. You don't spend enough time in deep sleep every 90-minute cycle, and you wake up tired.

For whatever cords you can't or don't shield, move them as far away from you as possible to minimize the electric fields. It would be helpful to use an electrical **body voltage meter** to see how various plug-in devices and lamps are affecting your body voltage. It's easy to tell if something is or isn't a problem if you just test it yourself or have a professional test it for you.

PRIORITY No. 2: INCREASE THE DISTANCE BETWEEN YOU AND THE EMFS YOU CAN'T AVOID

Remember to turn off the Wi-Fi and Bluetooth on your laptop, use a grounded power cord (instead of the battery), and connect to the Internet using a grounded Ethernet cable plugged into an Ethernet grounding adapter kit (see Resources for a retailer that sells these).

PRIORITY No. 3: REDUCE OUTSIDE SOURCES OF EMF

A few words about 5G

PRIORITY No. 4: SHIELD YOURSELF AND YOUR HOME FROM EMFS YOU CAN'T REMEDIATE

Not all EMFs are amenable to shielding and no one type of shielding blocks all types of EMFs. You need to learn the specifics and solicit the help of an EMF expert for the best results. **Shielding your bedroom is definitely the most important step to see an actual impact on your health.**

People turn off their Wi-Fi and remove all the wireless devices from their homes, but more often than not it's not until they shield their bedrooms that heart palpitations, insomnia, tinnitus, night terrors, and night sweats disappear.

The golden rule is to **have an RF meter available to take readings before and after shielding** to ensure its effectiveness.

P 214. Just type in "Geovital shielding paint" on YouTube and you will find a series of videos that provide detailed instruction on how to apply the shielding paint.

Remember, 4G will continue to use 600 MHz through 6 GHz, and new 5G technology will use the entire range from 600 MHz to 39 GHz, and eventually beyond 39 GHz. A good shielding paint and aluminium building foil will effectively block this entire range. While you could rely on a shielded tent, **most current shielding fabrics are not known to be as effective above about 12 GHz.**

(5G RF meters that measure frequencies above 20GHz are under development.)

Please remember, though, that Faraday bags do not protect you from keeping your phone on your body when it's not in airplane mode or off.

Remember Your Priorities

CHAPTER 8: THE PATH FROM HERE

P 219. I hope it is clear from the facts about EMFs I've revealed in this book that the rapid technological advancements of the 21st century have created a health challenge like no previous generation has been forced to face.

Ironically, it may be these very challenges - and the healthcare costs that accompany them - that provide a ray of hope that the economic forces that are responsible for our planet being deluged by EMFs will also play a role in reducing them.

INSURANCE COMPANIES TO THE RESCUE?

As the wireless industry unceasingly marches forward to blanket the Earth in an ever-growing intensity of EMFs, it may come to pass that insurance companies do the work of derailing, or at least slowing, the progression of EMFs. I hope this happens, as I don't have much faith that the government and its captured federal regulatory agencies will step in to protect us from the dangers of EMFs.

A 2018 article in *The Nation* titled "How Big Wireless Made Us Think That Cell Phones Are Safe: A Special Investigation" reported:

One key player has not been swayed by all this wireless friendly research: the insurance industry. In our reporting for this story, we found not a single insurance company that would sell a product liability policy that covered mobile phone radiation.

"Why would we want to do that?" one executive asked with a chuckle before pointing to more than two dozen lawsuits outstanding against wireless companies, demanding a total of \$1.9 billion in damages. (1)

It's not difficult to envision a future in which telecommunications companies are forced to pay huge fines and watch their stock prices plummet as a result - something that has already happened to tobacco companies, as I detailed in Chapter 3.

Another way insurance companies may impact the unchecked proliferation of EMFs is from the costs they pay for health care. Because EMFs contribute to chronic health conditions and inflammation, it is likely that a good portion in the rise in health-care spending is related to the accumulating effects of EMF.

P 222. In the meantime it is up to you to protect yourself and your family. It's up to all of us to become advocates and activists for better legislative policies regarding EMF-exposing products and infrastructures that permeate our world.

Exposure to EMFs should be treated like exposure to any of the well-known damaging effects to your health, such as **eating nonorganic and processed food, inactivity, and poor sleeping habits**. It is vital

to avoid them whenever possible. I hope this book

PUSH BACK AGAINST THE ADOPTION OF 'SMART' TECHNOLOGIES

Do you truly need these smart televisions, utility meters, plant waterers, and fitness trackers, simply because they are available? Consumer electronics companies can't exist without customers; **use your voice and your dollars to send a message about how much radiation exposure and data mining you will and won't accept.**

BRING BACK THE CORDS

PUSH YOUR COMMUNITY TO ADOPT A FIBER-OPTIC ALTERNATIVE TO 5G

Dr Timothy Schoechle, an expert on communications technology and a senior research fellow of the National Institute for Science, Law, and Public Policy, wrote a 156- page report for that institution in 2018, which states:

Wired infrastructure is inherently more future-proof, more reliable, more sustainable, more energy efficient, and more essential to many other services. Wireless networks and services are inherently more complex, more costly, more unstable, and more constrained (6)

YOUR CLOSING TO-DO LISTS

Your To-Do List for Reducing Your EMF Exposure

- Get a Meter EMFs are an
- Remove W-Fi from Your Home
- Minimize EMFs in Your Bedroom
- Bring Back the Cords
- Take Control of Your Cell Phone
- Help Your Body Repair the Damage from Exposure to EMFs. Thankfully your body has the capacity to repair this damage. Remember to take your magnesium. Nearly everyone is deficient in this important mineral, and one of its functions is to help block some of the calcium channels that EMFs stimulate.
- Keeping your NAD+ levels optimized is key to your DNA repair, and the older you are the more important this is as NAD+ levels drop very dramatically as you age. It is best to subscribe to my newsletter at mercola.com so you can be informed when they are available.
- the best ways to optimize your NAD+ levels and remediate the physiological damage triggered by EMFs are:
 - Practice daily time restricted eating where you only eat food in a 6- to 8-hour window or even less.
 - Engage in some type of daily exercise and seriously consider blood flow restriction training
 - Supplement with molecular hydrogen.
 - Have regular magnesium supplementation to reach at least your RDA of 400 mg of elemental magnesium.

P 228. Now I rarely use my cell phone unless I am traveling and then mostly for getting a ride to where I am going. My home has no Wi-Fi as all my Internet connections are through an Ethernet cable.

I shielded my bedroom from RF with EMF shielding paint and I now turn off the electricity in the room at night to keep electric fields low. I have also installed filters for dirty electricity throughout my house and at the main circuit breakers, and I have installed capacitors in all my solar panel inverters.

As you have learned from reading this book, the research that shows the **impact of EMFs** on your biology is being **suppressed**. It is my sincere wish that what you have learned has led you to the conclusion that you must take steps to protect yourself, your family, and the planet from these harmful frequencies. I hope that your eyes are now open and you are inspired to take action.

RESOURCES

P237. **A note about measuring the RF of MMW (millimeter wave) 5G signals: The band used by true 5G devices, above 20 GHz, will not be measured with any RF meter on this list. Such meters do not yet exist.**

OTHER PRODUCT RECOMMENDATIONS

Dirty electricity filters

Whole-house dirty electricity filters

There are also whole-house dirty electricity-reduction technologies. The one I recommend is the **Super Power Perfect Box**.

Ethernet grounding adapter kit

In order for your Ethernet cable to be grounded (and thus, not producing dirty electricity), you'll need an Ethernet grounding adapter kit.

Grounded Ethernet-to-USB adapters

Corded router with no Wi-Fi, or a feature that allows you to turn Wi-Fi off

RF-shielding wire mesh box (for covering a router)

Flicker-free monitors

Smart electric, gas, and water meter covers

EMF protective clothing

My favourite source for **clothing that protects your body from EMFs** - everything from hats to T-shirts to **gloves** to full-on burquas is LessEMF.com.

EDUCATIONAL RESOURCES

For pregnant women or women who plan to become pregnant, visit the website babysafeproject.org for specific guidelines on protecting your baby from EMFs.

How to File an ADA Accommodations Request for Electrosensitivity to Avoid Small Cells and Wi-Fi:

- <http://www.electrosmogprevention.org/ada>
- accommodations-for-rf-exposures/ada-for-es-to-avoid-small-cells-and-wifi/
- <http://keepyourpower.org/>
- <https://www.5gcrisis.com/> (To find a 5G group near you)

APPENDIX A

Damaging Effects of Excessive Peroxynitrite

- damages DNA, and when PARP repairs the damage it reduces cellular NAD⁺ stores. Once the level of cellular damage inflicted by peroxynitrite supersedes any possibility of repair, the cell eventually dies via one of the two main pathways of cell demise, necrosis or apoptosis. (1)
- Depletes antioxidant reserves, especially glutathione. (2).
- Creates a self-reinforcing vicious cycle of chronic inflammation (3)
- Triggers lipid peroxidation in membranes, liposomes, and lipoproteins by abstracting a hydrogen atom from polyunsaturated fatty acids, generating lipid radicals that propagate free radical reactions, thereby degrading membrane lipids and increasing risk of cardiovascular diseases. (4)
- Represents the major species responsible for DNA mutations linking NO (Nitric Oxide) overproduction with cancer. (5)
- Exacerbates oxidative damage to mitochondrial proteins (6)
- Alters protein structure and function (7) : Inhibits most components of the mitochondrial electron transport chain, thus decreasing ATP. (8)
- Inhibits superoxide dismutase, thereby preventing the breakdown of locally produced superoxide, which further fuels the formation of peroxynitrite. (9)
- Initiates peroxidation of myelin lipids leading to demyelination and plays a critical role in inflammatory diseases of the nervous system. (10)
- Causes endothelial dysfunction by inactivating prostacyclin synthase (PGI₂ synthase) and limiting endothelial NO production by inactivating eNOS through oxidation of its zinc thiolate center. (11)
- Causes tyrosine nitration in proteins, which is consistently observed in cardiovascular diseases and neurodegeneration. (12)
- PARP-dependent reduction of cellular NAD may also suppress NO formation by depleting endothelial stores of NADPH. An essential cofactor of NOS. (13)
- As one ages, it activates NFκB, a redox-sensitive transcription factor involved in the induction of the transcription of a large range of genes implicated in inflammation, including cytokines (e.g., TNF-α, IL-6, and IL-1β). (14)
- Oxidizes and depletes tetrahydrobiopterin (BH₄), which is known to produce a partial uncoupling of the NO synthases (eNOS, nNOS and iNOS). When these NOSs are uncoupled, they produce superoxide in place of NO. (15).
- Causes cardiolipin, the inner membrane of the mitochondrion, peroxidation, which leads to lowered activity of some of the enzymes in the electron transport chain and impaired ATP synthesis. (16)
- Inactivates Mn-SOD and makes mitochondria more vulnerable in neurodegeneration. (17).

APPENDIX B

Studies that demonstrate harmful effects of EMFs

- Cellular DNA damage: single strand and double strand breaks in cellular DNA and oxidized bases in cellular DNA, leading to chromosomal and other mutational changes:
- Lowered fertility, including tissue re-modelling changes in the testis, lowered sperm count and sperm quality, lowered female fertility including ovarian re-modelling, oocyte (follicle) loss, lowered estrogen, progesterone, and testosterone levels (that is sex hormone levels), increased spontaneous abortion incidence, lowered libido:
- Neurological/neuropsychiatric effects:
- Apoptosis/cell death (an important process in production of neurodegenerative diseases that is also important in producing infertility responses):
- Oxidative stress/free radical damage (important mechanisms involved in almost all chronic diseases; direct cause of cellular DNA damage):
- Endocrine/hormonal effects:
- Increased intracellular calcium: intracellular calcium is maintained at very low levels (typically about 2×10^{-9} M) except for brief increases used to produce regulatory responses, such that sustained elevation of intracellular calcium levels produces many pathophysiological (that is disease-causing) responses):
- Pulsed EMFs are, in most cases, much more biologically active than are non-pulsed EMFs. This is important because all wireless communication devices communicate via pulsations, and the “smarter” the devices are, the more they pulse, because the pulsations convey the information. What should be obvious is that you could not study such pulsation roles if there were no biological effects produced by such EMFs. The pulsation studies alone tell us that there are many such EMF effects:
- Cancer causation by EMF exposures:

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