

The Harmful Effects of Electromagnetic Fields on Health: A Special Interview With Dr. Martin Pall

By Dr. Joseph Mercola

JM: Dr. Joseph Mercola

MP: Dr. Martin Pall

JM: EMFs, electromagnetic fields: a pernicious health risk, but how do they damage your health? Hi, this is Dr. Mercola, helping you take control of your health. Today we are beyond honored and privileged to have someone to talk to and help educate us on this topic.

There are very few people I've interviewed – I've interviewed a lot of people, but very few who I believe truly deserve a Nobel Prize for his pioneering research in this area, to help us understand and identify the mechanism of how electromagnetic fields damage our cells. He's uniquely gifted to do this, because he has trained in physics and biochemistry. One of them is from California Institute of Technology (Caltech) and the other is from Johns Hopkins University, two very prestigious universities. He's also a professor emeritus of Washington State University. The man is Dr. Martin Pall, P-A-L-L. You're in for an engaging and amazing conversation. Welcome and thank you for joining us today, Dr. Pall.

MP: Thank you, thank you. It's a pleasure.

JM: Before we start engaging this, I just want people to understand your background and why, as I mentioned, you're so uniquely gifted in this area. Because most researchers don't have your skillset in training to understand the molecular biology of what goes on and how EMFs can cause us damage. Why don't you tell us your training? Then we can go on from there.

MP: I got my bachelor's in physics and I got my PhD in biochemistry and genetics. What I've been doing for the last 18 years or so is working on basically the medical literature, including basic science medical literature – putting things together that have been done by other people. There is a huge amount of information out here that nobody's got time to ration up, nobody's got time to integrate, digest and make connections. That's what I've been doing predominantly for the last 18 years.

I was interested in EMFs before I could understand how they worked. When I stumbled onto basically two papers that told me, "Well, this looks like the way they work," and then I dug out more and more papers. Initially 23, and then 24, and now 26. Actually, there are a number of others that I haven't published yet.

They all show that EMFs work by activating what are called voltage-gated calcium channels (VGCCs). These are channels in the outer membrane of the cell, the plasma membrane that surrounds all our cells. When they're activated, they open up and they allow calcium to flow into the cell. It's the excess calcium in the cell, which is responsible for most if not all, of the [biological effects].

JM: Let's stop there in your journey, because that was the original. There are hundreds of studies that show that when you expose cells to EMFs, there's increased intercellular calcium.

MP: That's right.

JM: That's indisputable. That's just fact.

MP: Yeah. You also get increases in calcium signaling, which is very important.

JM: Then you found these two dozen studies and put the whole mechanism together. I'm sorry for interrupting you. Why don't you continue?

MP: The importance of this is that the industry has been claiming for at least 25 years that ionizing radiation is dangerous, but this non-ionizing radiation can't do anything. You don't have to worry about it at all.

It's been very clear, going back all the way to 1971 and even before that, that this wasn't true. But we didn't know what the mechanism was. Now, we do. I think it's very important, basically because the industry's been trying to hoodwink everybody for decades. Now we know how it works.

One of the other things that's very important about this is that there is a wide variety of different health impacts that have been reported. Now we can explain how all of them work, or at least all of them may work.

JM: Yeah.

MP: There are plausible mechanisms leading off of this.

JM: We really haven't discussed the mechanism that you've put together, but why don't you bring us through the story of how you developed or found these studies on calcium channel blockers, a whole variety of different ones, two dozen? From there, you developed the mechanism.

MP: That's right. What the studies showed was that you could block or greatly lower the effects by using calcium channel blockers, which are highly specific, or these voltage-gated calcium channels. That was the key observation. As you've said, and I've said already, there are other observations that provide strong support for this as well.

JM: Yes. Maybe you can go into some of the details, because you had mentioned the heating effect, or what's commonly referred to in the literature as the thermal effect. The industry only believes it's a thermal. Your research shows clearly that it's non-thermal.

But let's go into the mechanisms of what happens. What do these calcium channels do? They open up. They allow calcium ions to go into the cell, which are really low-concentration normally. But when they hit the EMFs, they open up and they put a million ions a second per

channel into the cell and cause this molecular biological trauma that you've figured out. Why don't you go into that?

MP: Yeah. Okay. Let me just say one other thing before we go there.

JM: Sure.

MP: One of the other things about this is that these voltage-gated calcium channels – I abbreviate them VGCCs – have in their structure something called the voltage sensor. This is a structure that detects electrical changes across the plasma membrane and opens the channel. The obvious thing is that EMFs are working through the voltage sensor to activate the channel.

What is true – and this comes down to the physics – is that because of the structure of the voltage sensor and its location in the plasma membrane, one can predict from basic physics that it's extraordinarily sensitive to the electrical forces from these EMFs. The forces are approximately 7.2 million times stronger on the voltage sensor than they are on singly charged electrical groups that are in the watery parts of the cell, the aqueous parts of the cell, which is where most of them are.

There are extraordinary forces on this thing. That's how these very weak EMFs, which again industry claims can't do anything, are working. They're working by activating this. That's critical.

JM: Yeah. I couldn't agree more. I think that's one of your major findings. I just want to restate that in a way that some people may better appreciate that the consequence of that assessment, which you put together, means that the safety standards that are in existence today are off by a factor of over 7 million. They're 7 million times off.

MP: Yeah. This is an approximation. This is not a prescription.

JM: I know, I know. It might be 6.3. It might be 8. Who knows? It might be 4 million.

MP: It might be.

JM: But in that range.

MP: It might even be 2 million. But the point is that it's off by a lot.

JM: Yeah. By many orders of magnitude.

MP: Right.

JM: At least seven.

MP: Yeah. Then the question is, as you raised, what happens next? How do these lead to what we call effects? There are a number of things that we know, when we have excess calcium in the

cell, happen. One of the things is that you get excess calcium signaling. One of the things that's critical in that is you get increases in nitric oxide, okay?

Now, nitric oxide can work through its signaling. There's a nitric oxide signaling pathway. That is the mechanism by which you get therapeutic effects. There are genuine therapeutic effects that you get from these fields when they're at an appropriate level. When they're focused on a particular part of the body that needs some help, you can get therapeutic effects.

However, what we're concerned about most and obviously are the pathophysiological effects, the damaging effects, because it causes various kinds of diseases. How do they work? They work, I believe, predominantly by two different pathways. One is that nitric oxide can react with superoxide. Superoxide levels also go up in response to increased calcium in the cell, intercellular calcium. They form peroxynitrite, which is a potent oxidant. It's not a free radical, but it breaks down to form reactive free radicals.

[-----10:00-----]

JM: It's a reactive nitrogen species, instead of reactive oxygen.

MP: Well, it's both.

JM: Yeah. Okay.

MP: You get both. Because you get hydroxyl radical, you get carbonate radical.

JM: That's a question I had for you. What causes most of the damage? Is it the peroxynitrite or is it the hydroxyl free radical?

MP: It's not just hydroxyl, because the other free radicals are important as well. I think both of them do it, but I think most of the damage is caused by the free radicals rather than the peroxynitrite. But some of it is caused directly by the peroxynitrite.

JM: Okay.

MP: So you get a lot. As you know better probably than almost anybody else, oxidative stress and nitrosative stress are involved in almost every chronic disease you can name.

JM: Let me stop you there, because the devil's in the details. This is part of the solution, I think. It's not oxidative stress. The adjective that needs to be used is excessive oxidative stress, because there's a certain baseline free radical that's biologically useful and necessary, like nitric oxide is a free radical. You need it. But it's excessive nitric oxide, especially from stimulating the EMF, that causes the damage. Excessive oxidative stress.

MP: Yeah. What's interesting, actually – this I published, but there are not many places you can find it easily – is that those two pathways, which we just talked about – the nitric oxide signaling pathway and the peroxynitrite pathway – is each of them inhibits the other.

JM: I didn't know that.

MP: Yeah. If one of them turned on, it tends to suppress the other one. Depending on the condition, one of them may be dominant or the other may be dominant. I think this is an important thing for understanding this.

JM: That is so interesting, because I didn't develop this technique. It was developed by a friend of mine, Dr. Zach Bush, but it's a series of short exercises that take about three minutes that essentially is a high intensity exercise. But the sole purpose of that exercise is to increase nitric oxide production. I had no idea until you just mentioned that that will actually lower damage from EMF stress.

MP: Yeah. It will do that.

JM: Yeah.

MP: One of the things that I think is interesting here is that the EMFs can, to some extent – I don't want to overstate this – produce opposite effects, depending on the conditions that we use them in and the tissues that are being exposed and so forth, because these two pathways basically act against each other.

When the industry looks at studies, they say, "Oh well, this produces hypertension and then it produces hypotension. They must all be wrong. There's no effect." This, of course, is sheer nonsense, because the conditions that are used are different. You can get hypertension and you can get hypotension from EMF exposures. You have this kind of nonsense stuff that comes from the industry all the time that when you look at the actual mechanisms, there's no basis for this.

JM: Let's talk about that industry. I don't know if you studied it, but many other people have written about books about it. But many people watching this may not be aware that this industry, the telecommunications industry, is well-funded, and perhaps maybe even more well-funded than the pharmaceutical industry.

They do a very, very effective job of lobbying federal legislators and connecting with the media to give them disinformation that only supports their position. In the same part, they actively discredit. They've got these campaigns. Any research that comes up with opposing views is discredited and they're defunded. Monsanto does it classically and other drug companies.

MP: Yeah.

JM: Do you have any experience with that or can you elaborate on that at all? Or would we go to other experts for that?

MP: No. I know a lot about it. I know how they've attacked various people. In the U.S., we take great pride in our science. We have more Nobel Laureates than any other country, etc. But basically, the funding for the EMF research was cut off starting in 1986. What happened was that the EPA had some internal research that was going on in there. The funding for that was cut off

in 1986. The U.S. Office of Naval Research had been funding a fair amount of research in this area.

JM: That was in the '70s, 1971.

MP: Yeah. Okay. They were funding stuff, and after that too. They stopped funding new grants in 1986. There were grants that have been funded already in 1986. They went through the end of the grant period, but no grants were funded. And then the National Institutes of Health (NIH) a few years later followed the same pathway.

What's true is that now, in the U.S., it's actually shocking to say that there are two countries in the world that are doing a lot of research in this, well beyond their normal scope. They're doing vastly more than the U.S. is doing. They're Turkey and Iran.

It's surprising. I mean, there are other countries that are doing research in this. It's not just them. But it's interesting that we have two countries that we don't think of as being scientific powerhouses in any sense. But in fact, they're doing quite a bit of good research in both of those countries on EMFs. We need to give them credit for it. The U.S. is way down the list, because basically, there's no –

JM: It's been suppressed. The average person needs to know that it's hard to do science when you aren't funded. Really hard.

MP: Yeah.

JM: The industry knows this. They know this. They understand how research gets public. Neither of us, or I think any credible health clinician, is questioning the value of objectively done science, but it can't be done if you're not funded. It can be, but it's just more difficult.

MP: Well, it's very difficult to run a research lab with no money. You can't do it.

JM: Right.

MP: I mean, what I've been doing is I've been doing it on my own. I've been contributing my time to it and my efforts and, at least to a small extent, some money to it. But it doesn't cost that much.

JM: Yeah.

MP: So I can do it.

JM: Yeah. You're doing the literature research. The world owes you a debt of gratitude that they have no understanding of what you're doing, and really establishing the groundwork, the foundational basis for fighting this craziness that has been allowed to persist for the last 50 years. It's only going to get worse. It's only going to get worse, unless we take action.

MP: Yeah.

JM: You've got the basis of how we can take actions. I'm so excited for your work.

MP: Let me just get back to the industry.

JM: Sure.

MP: We have the fact that the money was cut off. One strongly suspects the industry had a role on that. The industry, with the 1996 Telecommunications Act, gave the regulation to the Federal Communications Commission (FCC), which has done nothing in terms of protecting the public. In addition, they prevented the public from protecting their health with regard to their exposures from the cellphone towers. We could not sue to prevent cellphone towers from being put near our workplace or homes.

JM: I believe the laws have been changed or pretty much set up like they did with vaccines. It's physically impossible to sue a vaccine manufacturer for damage. I think they've set something similar with the telecommunications, where you can't sue them.

MP: That's right.

JM: They have immunity, immunity to litigation.

MP: Yeah. Basically, what the Congress did was to say our health makes no difference.

[-----20:00-----]

JM: Yeah. Right. It's not getting better. I mean the new head of the FCC is the lobbyist for the telecommunications industry. How crazy does that get? That is putting the fox guarding the henhouse and making them the head farmer.

MP: The corruption in this thing has gone – It's been bipartisan corruption, you know? It's gone through Reagan's last term; Bush, one; two terms of Clinton; two terms of Bush; two terms of Obama; and it's continuing even worse under our current administration. We're in extremely deep trouble. We really haven't talked yet about why we're in deep trouble.

JM: Okay. Let's go in there, because this is the reason. Because I think where we're going next is to where the highest density of the voltage-gated calcium channels is, and what diseases are going to be a consequence of that exposure.

MP: Right. Yeah. Okay. The VGCCs – Before I do that, I just want to say that a lot of the pathophysiology also has to do with excessive calcium signaling.

JM: Okay.

MP: It's not just the peroxynitrite pathway. That's very important, but it's also true that there's a lot of excessive calcium signaling effects. Calcium signaling is very important. When you've got

way too much of it, you have lots of problems. That's another part of the story that's important to keep in mind.

JM: Okay.

MP: Where are these VGCCs? Where are they located? The highest density is in the nervous system. There are studies going back to the 1950s and the 1960s, rodent studies that show that the nervous system was the No. 1 organ in terms of sensitivity to these EMFs. There were studies done that show that there were massive changes in the structure of the neurons, including cell death, dysfunction of the synapses and many other things. The brain is very sensitive. The heart is also sensitive. I think that the pacemaker cells of the heart are particularly sensitive. They have the highest –

JM: It's good to see that, but I just want people to know that the consequence of that sensitivity means cardiac arrhythmias, atrial fibrillation, atrial flutter, premature atrial contractions (PACs) and premature ventricular contractions (PVCs). If you have these things, EMF is a massive contributing factor. You've got to pay attention to it. We'll discuss that later. So, cardiac arrhythmias.

MP: Yeah. Yes. Well, also tachycardia and bradycardia – fast heartbeat and slow heartbeat.

JM: Okay, good. Those are others.

MP: We also get heart palpitations.

JM: Which is a PAC or PVC.

MP: I don't know how each of those are generated, but I think that –

JM: Well, it's typically a premature atrial ventricular contraction. That's why they call them PACs or PVCs, so palpitations.

MP: Yeah. Okay. As I'm sure you know, arrhythmias are often associated with sudden cardiac death. We have an epidemic of young, apparently healthy athletes dying in the middle of an athletic competition, something that was extraordinarily rare in previous decades. Now, in the last few decades, it's been happening more and more often. I think it's due to the EMFs. I can't tell you for certain that's true, but as far as [inaudible 24:09] that hardly explains it. There are those things. Now, there are also effects on reproduction. The VGCCs have very important mechanisms in the reproductive system, basically in fertility and procreation.

JM: Is it more on the testes or the ovaries?

MP: The testes have been more studied.

JM: Okay.

MP: But I think it's both.

JM: Okay.

MP: But there are much more data on the testes. There is evidence for both causing male infertility and female infertility. But the male infertility has been much more studied.

JM: Okay.

MP: It's much easier to study. I think it's both. Maybe I can tell you about a classic experiment that was done on reproduction that was published 19 years ago by Ioannis Magras and Thomas Xenos in Greece.

They took young pairs of mice, one male and female. They put them in a little cage on the ground outside in an antenna park. We have a bunch of broadcasting antennas. The levels at the ground were well within our current safety guidelines. The safety guidelines have [inaudible 25:52] there shouldn't be anything that happens. They put them in two different locations, one with a higher level of exposure and one with a lower level of exposure. What they found was that at the higher level exposure, each pair produced one litter that was approximately normal sized, maybe a little bit down, then a second litter that was clearly down in numbers and then complete infertility – not a single mouse born.

That only takes 30 days. The gestation period in mice is about 30 days. It takes about 30 days to go through these things. It's a quick experiment. At the lower level exposure, it was basically the same story, except it took twice as long. They produced, in fact, four litters with decreasing numbers, and then complete infertility. We have now, in humans in many, many countries around the world, decreased male sperm count.

JM: Yeah. Down by 50 percent or over 50 percent in most countries.

MP: Over fifty percent in Western countries and about half of that amount in other countries around the world. The senior author in that paper is saying, "If this keeps going, we're going to become extinct." Just from the drop in male sperm count.

JM: Yeah.

MP: We know that that occurs in humans – in people who carry their cellphones in their front pockets, men who use their laptops with the Wi-Fi on sitting on their lap. We know that occurs. Of course industry denies everything I have to say with that.

JM: Sure.

MP: By the way, it also occurs in – this has been studied in animals [inaudible 28:00].

JM: No question. I want to go back. You've mentioned the extinction of the species. I think you're spot on. This is what we are contending with. You have the decrease in fertility, but

you've also mentioned the nervous system, the increased density there, but you didn't mention the consequences of that.

There are three consequences – the A's, which would be anxiety – because their voltage-gated calcium channels are responsible for the neuroendocrine hormone release and neurotransmitters – anxiety and depression, autism and Alzheimer's. Why don't you expand on that? Because you gave a brilliant presentation at AutismOne.

MP: Thank you. Okay. You've been doing your homework. I'm impressed.

JM: Yeah. If you've got autism on one end, at the beginning end, and Alzheimer's at the next and you're not fertile, what's going to happen to humans? There's no 22nd Century.

MP: Yeah. Let me just go off on something else.

JM: Okay. Sure.

MP: The one thing that I really published on in substantial detail is on the neuropsychiatric effects.

JM: That's right.

MP: I already said you get a massive, sort of cumulative effects on the brain in animals exposed to these EMFs. The VGCC mechanism predicts that you're going to get massive effects in the brain, because they're such high densities and they're so important in the brain.

We also have, interestingly, genetic polymorphism studies, which show that elevated VGCC activity, for the most important [part] in the brain, produces numerous kinds of neuropsychiatric effects. We know you can get neuropsychiatric effects from this mechanism.

[----30:00----]

What I did was I reviewed a whole bunch of studies on various kinds of EMF exposures, each of them showing neuropsychiatric effects. What you find is that these effects have been repeated many times in these epidemiological studies. It's the same thing that everybody's complaining about, "I'm tired all the time," "I can't sleep," "I can't concentrate," "I'm depressed," "I'm anxious all the time," "My memory doesn't work well anymore."

JM: Sure.

MP: All the things everybody's complaining about. We know all those things are caused by EMF exposures. There's no doubt about that, okay? Because we know their effects on the brain, we know that the VGCCs' excessive activity can produce various neuropsychiatric problems. Here we've got all of these epidemiological data that confirms this is happening in humans who live near cellphone towers, who were exposed to Wi-Fi, who were exposed to broadcasting radiation, who use cellphones, tablets, etc. That's going on. That's very important. I think that we should care about this.

JM: Let me expand on this, because the other issue is cancer. I just wrote the book *Fat for Fuel*, which really discusses about the metabolic theory of cancer and focuses on the function of the mitochondria. It seems to key in perfectly with what you're teaching, because the EMFs actually cause excessive oxidative stress, which can damage mitochondria.

MP: Yeah.

JM: You've mentioned early on that these VGCCs are in the cellular membrane. I don't believe they're on the mitochondrial cell membrane, though. Are they just on the external cell membrane?

MP: I'm not sure about that. I tried looking that up and I'm not sure whether there is or there's not.

JM: But anyway, this excessive oxidative stress can damage mitochondria. We know that contributes to cancer. That's why women who put their cellphone in their bra get cancer in the upper inner quadrant, which is a very rare place to find cancer. It's almost always in the upper outer quadrant. People who put it on their ear get brain cancer.

In some ways, I think that publicizing and emphasizing the danger of EMFs to cancer is counterproductive, because most people don't know people with brain cancer dying from cellphones. They know everyone uses cellphones. But what they do see is people dropping like flies from lack of energy, from heart attacks, from cardiac arrhythmias, from autism, from Alzheimer's. These they see. They have to understand it's not just the brain cancer. It's everything else. That's the key.

MP: In my judgment, cancer is down around number four or number five on the list of my concerns.

JM: Yeah.

MP: It's not that there's anything about cancer that's not important. I mean it's very important. We're just looking right now at the early stages because of long latencies.

JM: Right. Let's address that. The latency is, there's virtually no one watching this. Less than 1 percent of you had a cellphone in 1995 or 1997. We're talking about two decades. That's it. Then there was just a progressive increase. In most people, it's probably this century that they had a cellphone. It's not that long.

MP: Yeah. You know, the studies on cancer have been blocked in a lot of ways by the industry. In particular, by preventing researchers from getting information about how heavily the cellphones have been used. Basically, you can't get the information about how heavily individuals have been using their cellphones. Even if there are individuals who are willing to have the data released, you can't get that. From the industry, they won't give it to you.

Obviously, it's the people who use these most heavily who are at great risk. There is some epidemiology that shows that, but it's much harder to get because of the industry's position.

JM: Yeah.

MP: The other thing I want to say is that, with regard to cancer, we know that EMFs cause DNA damage to our cells.

JM: Single and double stranded breaks.

MP: Single or double stranded.

JM: By the alkaline comet assay, right?

MP: Yes. There's also a lot of data that's never been reviewed, but there's a lot of data that you get excessive levels of oxidized bases, particularly 8-hydroxydeoxyguanosine.

JM: I've got one question on the DNA breaks.

MP: Yeah.

JM: What do you believe causes more DNA breaks? Ionizing radiation in the air, gamma rays at 40,000 feet, conventional X-rays, computed tomography (CAT) scans or regular use of the cellphone? It seems like from your literature, you're thinking it's the micro variations that are going to cause more DNA breaks.

MP: Well, yes. I do think that's true. The question is, what's the evidence? There were three studies that were published by a group in Germany headed by Professor Franz Adlkofer.

JM: The studies. They're in German.

MP: Yeah. Franz Adlkofer. He did two of these in collaboration with Hugo Rudiger in Austria. The first study was done where they compared ionizing radiation, the equivalent of 1,600 chest X-rays – these were done in cell culture – they compared them with the DNA breaks that you got from what they described as 24 hours on the cellphone. I'm going to tell you that it's actually not a cellphone [inaudible 37:11] that was studied. What they found was roughly equivalent amounts of DNA breaks from the two.

JM: Two days on a cellphone equals 1,600 X-rays DNA damage?

MP: Twenty-four hours and 1,600 chest X-rays.

JM: In-vitro assays.

MP: That was what they found out. Now, in fact that underestimates the effects of cellphones. Okay? First, because they used a continuous wave EMF.

JM: It's not pulsed.

MP: We know there's extensive evidence that the pulsed EMFs are much more damaging than the continuous wave EMFs. That's important for quite a number of reasons, including the fact that all wireless communication devices communicate by self-pulsations. They're much more dangerous because of that. Then they published two other papers. One was they compared pulsed EMF with a non-pulsed EMF. [inaudible 38:14] acid was more active.

And then they did a third paper, which is the paper that industry loves to hate. The senior author was C. Schwarz. It's a Schwarz, et al. paper. These were all published in English by the way. That paper showed that when you used pulsations that were designed to be similar to what the pulsation you get from a real cellphone, you got still much more damage at much lower intensities. Cellphones are highly active. This raises the question, "How can this possibly [do this]?" I think the answer actually comes from the kind of diagram that I've published, which is how EMFs produce free radicals.

JM: We'll have a copy of that in our article so that people can see that.

MP: Okay. Great. What you get then is the – Both ionizing radiation and the microwave frequency EMFs produce DNA damage through free radicals, okay? They're similar in that way. In a way, where you get the free radicals is through the peroxy-nitrate pathway. It turns out that when you go from EMFs to the free radicals on that pathway, there are three steps that involve high levels of amplification.

[----40:00----]

One of them is, as you mentioned before, when you open up the channels, you get about a million calcium ions flowing in per second. The second is that you get increases in nitric oxide and superoxide. Those, in effect, will be the calcium acting catalytically, because once it's in the cell, as long as it's elevated, you keep getting more and more of those things. And then those two react with each other to form peroxy-nitrite. The reaction rates are the product of the two. You have three levels of amplification. If you have three levels of amplification, you get a hell of a response to a very small ion.

JM: It's interesting, because it's true. The industry is saying that there's not enough energy in a microwave radiation to cause direct damage to the covalent bonds in the DNA. There isn't. It's only the biological amplification resulting in excessive oxidative stress that causes it. Interestingly, the ionizing radiation that causes the damage – I think in one of your papers you mentioned too that that ionizing radiation that has the energy to break the bonds. But actually, more of the breaks are due to the secondary oxidative stress that breaks the DNA. It's not directly from the energy within the radiation.

MP: Right. Yeah. That was published by Arthur Compton. He got the Nobel Prize for it in 1927. The way in which ionizing radiation works, it basically gets molecules and atoms and knocks electrons out, and then you get pairs of free radicals generated. That's called Compton scattering.

JM: Yeah.

MP: There is amplification from ionizing radiation, but it's only at one level. Namely, that one level that you just mentioned.

JM: Right.

MP: You've got three levels of amplification with the microwave frequency EMFs. The amount of damage you get based on those studies is truly extraordinary. Of course, as I think you know, Adlkofer and Rudiger were severely attacked by the industry.

JM: Yeah. He has an interesting history.

MP: This is absolutely beautiful work.

JM: I think it was his organization Veritas. He was hired by the tobacco industry initially. It was founded in Germany. Debra Davis did a nice job explaining his whole process.

But I want to get back to what we can do, because now that we've – Hopefully, we have appropriate concern about this issue now. So, what they can do. I want you to help us understand and prioritize our exposure. That would be really good to understand.

Let me name the exposures: cellphone towers, which I think are relatively low down on the list, unless you're right next door to one; your cellphones is a huge one; Wi-Fi routers; Bluetooth, Bluetooth headsets or any Bluetooth objects; the intermittent things; smart thermostats; baby monitors; smart meters; and then one of the most important ones, which hardly anyone looks at, is actually the microwave itself, which initially was developed as the radar range. Microwaves are radars. That's the signals they use.

I want to show you a video right after this showing people that there are different devices you can get to measure microwaves. No, it's not a Trifield Gauss Meter. That does not measure it. You have to use specific devices to measure from the few hundred megahertz to the gigahertz range and see what it is. When you turn on your microwave, within 10 to 15 feet, it's 1,000 times higher radiation, 1,000 times, which is more than your cellphone. From your perspective, I'm wondering if you could prioritize those risk factors so that people know. The first step in helping yourself and your family is to limit the exposure.

MP: Yeah. Let me just say I've researched at least some of the evidence on cellphone towers and cellphones. Cordless phones, by the way, are also problematic.

JM: Yeah. I forgot those. Yeah. We did have an abundance of those. Right.

MP: Wi-Fi and smart meters, there's very little data on smart meters, basically for the same reasons I talked about before. There's no money. But what data we have looks bad. Certainly, the anecdotal reports that one gear is that those are bad. But they're all bad. All of those are bad. Microwave ovens, I'm not so sure about, because I really haven't researched that.

JM: You don't have to guess. You can buy these meters. They're not horribly expensive. They're only hundreds of dollars. They're not like thousands.

MP: No, no. I know that.

JM: You can buy them and measure it yourself in your microwave oven in your home.

MP: Yeah. I use a Cornet meter pretty regularly. But the problem basically is the following: we know that – as I mentioned before, that the pulsed EMFs are, in most cases, much more active than the non-pulsed EMFs, the continuous wave EMFs. But the other problem is –

JM: Is a microwave oven continuous or pulsed? Is it continuous?

MP: Well, it's pulsed. But it's pulsed basically because it runs off the 60 hertz curve.

JM: Okay.

MP: Okay? You have a particular kind of pulsation. It's not just the question of how much you've got, but how dangerous is that kind of pulsation versus other kinds of pulsation. It's not an easy thing to say. I think, in general, and this has been argued by a number of people, including Dimitris Panagoupolos in Greece, the more pulsed things, are the more dangerous they are. But that's at least roughly right, but it may not be precisely right.

We have a lot of problems, but in general, it's not that easy to make the kind of health assessment without data. But the basic problem we have, the fundamental problem we have, is that not one of these devices, not even one, not even once, was tested biologically for safety before they're put out to expose an unsuspecting public. They are never tested for safety. All the assurances of safety are based on this theory that they can only produce effects by heating. We've known that we're paying attention to the data that was run 45 years ago.

JM: And even with that flawed assessment, there's still a warning on every phone to hold it more than an inch away from your head.

MP: That's right. Yeah. That's right. Which people don't know about, because they're in very fine print. It's bizarre. As you mentioned before, my best estimate of the safety guidelines is they're off by a factor of something like 7.2 million.

JM: Yeah.

MP: We're in an absolutely insane situation. I mean it's just crazy.

JM: But it's important to know – What I've neglected to mention is that your understanding of this came in 2012. You published in 2013. It was a highly cited article, and still is. It won an award. It's only been published for four years. You've had some effort. We're going to seek to

publicize this and make this public aware. Because once you know the mechanism, you can remediate.

I want to talk about that now if I can. It's that you put together the mechanism through the two dozen studies that had calcium-channel blockers. I personally would never use or recommend a drug – I mean not never, but virtually never recommend. Obviously, there are exceptions for every rule. What's the natural alternative to form a calcium channel? It's magnesium. Virtually everyone's deficient in magnesium.

I'm wondering if you've reviewed any or if you've had any thoughts on the molecular biology of high-dose magnesium. I'm talking like well above 500 percent higher than the recommendations, like maybe 2 grams of elemental magnesium a day, to serve as a blocker to stop – like the calcium channel blockers did in the studies in the in-vitro and the animal studies – to block the effects of EMF or radically reduce them.

MP: I don't know of any data on that. I heard that there can be problems with very high levels of magnesium.

JM: I want to talk to you afterwards. We're going to fund some research to look at that.

MP: What I'm saying is that the main problem with magnesium, I think, is the one that you mentioned before. That is that almost all of us are magnesium-deficient because our diets are low in magnesium and because the soils have been depleted in magnesium.

[-----50:00-----]

It is clear that when we're deficient in magnesium, you get excessive activity of the VGCCs. It's important to allay that deficiency.

JM: That's documented. When you're magnesium deficient, you have increased VGCC activity.

MP: Yeah. I mean, at least in animals it's been shown and also cells in culture you can show that. The, other thing, which is clear is that you also get excessive calcium influx through the N-methyl-D-aspartate (NMDA) receptor. That's problematic as well. It's certainly good and important to allay the magnesium deficiency. I think we should all be doing that anyways.

JM: Alright. The question is that the research shows that deficiency in magnesium will contribute to enhanced VGCC activity, but it doesn't know that an increase in it would actually block that receptor. We don't know that yet.

MP: The problem is that receptors are important for function.

JM: Yeah. But it's much better to block it with something [more] natural than a drug, which is indiscriminate.

MP: I don't think we can block it.

JM: At least reduce it. Reduce it.

MP: Yeah. There are other ways of – I always tell people I'm a PhD and not an MD. None of these should be viewed as a medical advice. But I think one approach to dealing with these things is to raise the level of nuclear factor-like 2 (Nrf2), which I published on.

JM: Yes. That's a biological hormetic, which upregulates the superoxide dismutase, catalase and all the other beneficial intercellular antioxidants.

MP: Yeah. It does that, but it does many other things as well.

JM: Alright. Tell us what else it does.

MP: Well, it lowers inflammation. It improves mitochondrial function. It helps detoxify the body from both carbon-containing toxicants and toxic metals. I guess that'll do for a starter.

JM: Yeah. How do you activate Nrf2? The common way is sulforaphane from cruciferous vegetables, like broccoli.

MP: Yeah. But there are many, many other nutrients that raise Nrf2. I published a paper on that.

JM: You're going to have to give me that paper.

MP: Okay. You can pull it out of PubMed.

JM: What's that? What's the title?

MP: Just put in my last name, P-A-L-L, and initials, M-L, and Nrf2. It will pop right up and you can download it.

JM: Okay. Good. Yes. I've got a novel, targeted selective antioxidant that I think would be really useful. That also stimulates Nrf2. I want to talk to you about it off-camera.

MP: There are a lot of things that raise Nrf2. They include the long chain omega-3s and fish oil. They include a lot of phenolic antioxidants. The sulforaphane that you mentioned, the isothiocyanates from the cabbage group. They include – I'm trying to remember which one. They include a lot of the sulfur compounds in garlic and onion. They include terpenoids. A lot of plant materials – in fact, a lot of things that occur in various kinds of herbs, including herbs that we eat and also traditional herbal medicine.

JM: Sure.

MP: There are a lot of things that raise that too. They include the carotenoids, which I didn't mention.

JM: Yeah. Carotenoids are good. Interesting. I did not realize that carotenoids upregulated the Nrf2 pathway. I did not know that.

MP: Okay. Yeah. Anyway, you should read my paper.

JM: I am definitely going to read it. Believe me. I will read it very soon.

MP: There are a lot of good stuff in there.

JM: You just provided us with the mechanism of how eating a healthy diet helps lower the damage from EMF exposure through the Nrf2 pathway.

MP: Yeah. One of the things that I argued in that paper is that the two most helpful diets known – the traditional Mediterranean diet and the traditional Okinawan diet – are both high in nutrients that raise Nrf2.

JM: Yeah.

MP: I think a lot of the health promotion of those diets goes through that pathway.

JM: Excellent.

MP: By the way, this connects with something else we talked about. The nitric oxide signaling pathway raises it.

JM: Yeah. Right.

MP: I think it's one of the mechanisms that's important for those two pathways working against each other. The nitric oxide signaling pathway regulates the peroxynitrite.

JM: I did not know that either. I did not know that affected Nrf2. It's not just creating the nitric oxide. It's actually releasing it as a signaling molecule into your circulation, which is what you do with a nitric oxide dump. Look up my other video – maybe we'll put it in here – because you should do that if you're concerned about cellphone exposure, because you're going to lower your response to inevitable exposure. Yes, you should lower your exposure, get a meter, measure it, and lower it as much as possible. But you also want to live a healthy lifestyle. By doing that, you'll actually improve your ability to withstand the damage from it.

MP: Yeah. I mean, obviously avoidance is the key thing here and will always be the key thing here. But there are other things that are useful.

JM: We've kind of reached the end of our limit that we do for normal interviews. If you would like to emphasize some points, summarize or make a recommendation for resources to go to, and then we'll conclude. We'll probably have you on again because you're such a wealth of information.

MP: One thing I'd like to emphasize is that this whole nonsense that the industry had been putting forth is just that. It's just nonsense. We are literally destroying our health in many different ways.

I think we talked about the extinction issue. I think there are actually six different ways in which it's probable that we will generate our own extinction rather quickly from these EMFs. But I think one of the things that's important here is that when you look at the effects of EMFs on the brain, and when you look at the effects of EMFs on the reproductive system, they both develop slowly over time. Those are the things we're not aware of, because they develop slowly. I mean it's not like getting hit in the head by something. It develops over periods of months and sometimes years.

JM: Like smoking.

MP: We're not aware of them even though they are cumulative and they develop quite severe effects. This is something where – I think people are not aware of this because they develop slowly over time despite the severity of the eventual effects. That's something that I think all of us should keep in mind.

JM: Okay. Sage advice. Again, I cannot thank you enough. I'm going to serve as a surrogate to express the sincere gratitude that we have for the pioneering work you have done in elaborating on the biological mechanism from EMF damage, which has such massive potential to really fight the misinformation of the telecommunications industry and really hopefully help us get back to biological safety standards – not back to, but at least adopt them – and then develop some remediation strategies that can actually limit or radically reduce the damage. Thank you very much.

MP: Thank you.

[END]