

The dubious handling of the radiation hazard

Currently the frequencies for the mobile radio standard 5G are being auctioned off. It is not even clear what concrete effects electromagnetic radiation will have on humans. Studies that warn of risks are hardly considered.

More antennas, higher frequencies - the development of the new 5G mobile radio technology continues a trend that has been going on for decades: People are increasingly exposed to electromagnetic radiation. WLAN, home networking, wireless headphones, baby phones, cars, mobile phones. Increasing data hunger will further increase radiation exposure, because the more data transmitted, the more radiation the device emits.

Eight years ago, the World Health Organization's Cancer Research Agency classified high-frequency electromagnetic radiation, which occurs primarily when mobile phones are used, as "possibly carcinogenic" to humans. For years, electrosensitive people have complained of pain and sleep disorders caused by electromagnetic radiation - and are laughed at. But recent studies provide new evidence that mobile radio radiation can cause damage even before legal limits have been reached. This in turn raises the question: How do these limits actually develop - and who sets them?

"Of course, everyone is exposed to electromagnetic radiation all the time, but the point is: the higher the intensity, the greater the risks.

David Carpenter, Director of the Institute for Health and Environment at the University of Albany, USA. The health researcher is one of the most prominent warners against electromagnetic radiation.

"There are natural electromagnetic fields, life has developed in their presence. But in recent decades, the electromagnetic radiation we humans are exposed to has increased enormously. In the past, human sources of electromagnetic waves were radio and television. Today we have WLAN everywhere; we are developing self-propelled cars that use electromagnetic fields to navigate; everyone has a mobile phone. And 5G will increase the amount of radiation."

Carpenter recently co-wrote a commentary for The Lancet, the second largest medical publication in the world with a first-class reputation. This commentary lists a number of studies that are said to have demonstrated harmful effects of electromagnetic radiation before current limits were reached. David Carpenter of Albany University concludes in his commentary:

"There is an urgent need to tackle so-called electrosmog. The weight of this scientific evidence refutes the claim that wireless technologies do not pose a health risk at the currently permitted non-thermal limits."

Researchers have been warning for years

Years ago, David Carpenter one of the editors of the "BioInitiative Report" together with 29 other scientists, professors and medical researchers from eleven countries. The researchers refer to 1000 scientific publications and write:

"The biological effects of mobile radio radiation prevent the body from healing damaged DNA and reduce resistance to disease. This can have a profound effect on metabolic and reproductive functions."

That was seven years ago, but not much has happened. Today, David Carpenter says with a view to the new 5G generation of mobile phones, the frequencies of which are currently being auctioned off in Germany:

"We want a break. We are not saying that 5G should never be introduced, but at least we need to have a debate about what the benefits are and what the risks are. And our fear is that the risks are significant, they have been ignored and the public doesn't even know about them."

Before going any further into the studies that have raised such concerns among some scientists, we need to say something about electromagnetic radiation itself, a few undisputed properties.

Electromagnetic radiation transmits energy. When the radiation hits our body, this energy is absorbed by the cells. If the energy content of the electromagnetic radiation is very high, scientists speak of ionising radiation. Because the energy is sufficient to change atoms and molecules, says radiation biologist Eric van Rongen:

Ionising radiation can, for example, break up the molecules of our DNA, the chromosomes. This effect can lead to health problems such as cancer.

This danger emanates from X-rays, electromagnetic radiation with a lot of energy. However, power lines, computers in WLANs or even mobile phones emit radiation that transports much less energy - so-called non-ionising radiation. Even for this radiation with relatively little energy, there are limits to protect the human body from potential damage. **However, the question of how this limit is set is highly controversial.**

For the past 20 years, the temperature of the body has been used as a benchmark

Visit to the Federal Office for Radiation Protection, the authority in Germany that recommends limit values. Inge Paulini is the president. Limit values for

radiation with little energy, such as in mobile radio, she says, have been based on the thermal effect for over 20 years.

"The thermal effect means that when we are exposed to radiation, there may be an increase in temperature in our bodies."

The body temperature can rise when electromagnetic radiation is absorbed by the body and converted into heat energy. However, our body constantly changes its temperature to a certain extent - through exertion, sleep or radiation from outside. With a little more heat, the body can cope.

"The important thing is to know that there is a value, and that is fixed with 1 degree additional body temperature, that from then on we say: We have to be careful because these natural regulatory mechanisms may no longer function so well and only then can damage occur.

The limit value for electromagnetic radiation is therefore always derived from this thermal effect. Example mobile phones: A mobile phone may only transmit so strongly that it warms the tissue in the head from a certain distance by an additional maximum of 1 degree. A limit value that is rarely reached and is not a problem for the telecommunications industry.

A powerful association ICNIRP writes the guidelines

If the body gets warm or not - this decisive criterion is over 20 years old and was conceived by a private - and at least initially very industry-oriented - scientists' association, the "International Commission for Non-Ionizing Radiation Protection", ICNIRP for short.

This association has been writing guidelines for decades, according to which criteria radiation limits should be set - and most countries in the EU, Australia, Japan and some Asian countries adhere to them according to ICNIRP. Chief of this powerful association is the already mentioned radiation biologist Eric van Rongen. He still considers the thermal effect introduced 20 years ago to be scientifically reliable: this is the only effect proven by scientific literature.

"The criteria for the exposure limits is to prevent too much heating of the body. That is the only effect that is established from scientific literature."

"This approach is not mature enough," says pharmacologist John Bucher of the National Institute for Environmental Health, a research institute of the US government. It is too simple to assume a danger for humans only when the tissue heats up by an additional 1 degree:

"We don't know the risk."

"There's always a warming of the tissue. However, we do not know the risk of the warming that occurs when we use a mobile phone in a typical way.

Health professor David Carpenter writes in his commentary for the medical journal The Lancet:

"It has now been proven that the prevention of tissue heating is not suitable for preventing biochemical and physiological disturbances.

An evaluation of more than 2200 studies has shown that this is the case: The vast majority of these publications conclude that electromagnetic radiation often has a biological or even health effect on humans before the radiation warms the tissue by more than 1 degree. This means, writes David Carpenter in an email, that electromagnetic radiation can lead to skin damage, low life expectancy, weight loss, changes in behaviour or even molecular changes in the tissue even before 1 degree warming. This evaluation would doubt The Federal Office for Radiation Protection sums up the results of the Interphone study quite differently, headline:

"It's absolutely true that there are effects in the human body that have nothing to do with warming."

For example, the electrical activity of the brain could be influenced. But the body can cope well with these effects below the 1-degree warming limit:

"It has never been proven that these effects really have health effects."

"Well, that's just nonsense.

That is simply nonsense, says David Carpenter, Professor of Public Health at Albany University:

"We have clear evidence of an increase in brain cancer in people who use mobile phones for long periods of time and this increase is only on the side where they use the mobile phone. Take the Interphone study."

Other studies with different results

Okay. Then we come to the central studies, which in the eyes of some scientists prove that mobile radio radiation in particular can cause damage within the applicable limits before the tissue heats up by an additional 1 degree.

The Interphone study led by Carpenter was initiated by the UN in 2000. In 13 countries, over 5000 cancer patients were asked for years how they used their mobile phones. Sweden contributed to the surveys by cancer researcher Lenart Hardell. They showed that brain tumours occurred mainly on the side of the head where the mobile phone was pressed when making a phone call.

Hardell therefore considers it "proven that high-frequency electromagnetic radiation increases the risk of brain tumors. The overall result of the Interphone study contributed to scientists at the UN Cancer Research Agency classifying electromagnetic radiation as "possibly carcinogenic" in 2011.

The Federal Office for Radiation Protection sums up the results of the Interphone study quite differently, headline:

"INTERPHONE study finds no increased tumor risk by mobile phone use

If one reads the evaluation of the Federal Office for Radiation Protection to the end, however, the reference is found there:

People who use their mobile phones a lot have "a statistically significantly increased risk" of developing both a brain tumour and a tumour of the auditory nerve.

And further literally:

"The intensive mobile phone users showed the gliomas..."

In other words, brain tumours.

"...rather in the brain regions that are close to the ear and on the side of the head that was indicated as the preferred side for making phone calls."

And how does the Office nevertheless come to the conclusion that the study "found no increased tumour risk through mobile phone use"? According to the Federal Office for Radiation Protection, the answers of the frequent users to the extent of their mobile phone use were "not comprehensible". This would make the "results of this part of the study appear questionable".

"Biological effects appear in rats".

Further evidence that electromagnetic radiation can cause damage before tissue warms up was provided last year by a large-scale study of the National Toxicology Program, NTP for short, a research program of the U.S. Department of Health and Human Services. The scientists had exposed around 7000 rats and mice to electromagnetic radiation throughout their lives, with a frequency similar to that of older mobile radio standards.

"When we started the study, one of the big questions was: Is it possible that non-ionizing radiation can cause biological effects before the tissue heats up more than 1 degree, so before the thermal effect occurs?"

Says John Bucher, one of the authors of the NTP study. The result is clear:

"We have found out that biological effects occur in rats. This is an important result."

This "biological effect" of electromagnetic radiation was: cancer. The US researchers thread "clear evidence of tumors in the heart of male rats".

"We have found tumors in various organs."

The problem with the study: the rats did not heat up by more than 1 degree, says Bucher. However, they were exposed to a radiation dose that is significantly higher than that expected from typical mobile phone use today. Therefore, the results are relevant for humans, but not directly transferable.

"Obviously we think the findings are relevant for humans. There are difficulties in the direct extrapolation."

However, this weakness of the US study is filled by the research of Fiorella Belpoggi, a renowned cancer researcher from Bologna. She, too, had rats irradiated, but with less energy, so that the rats were burdened in the same way as humans were burdened by mobile phones. Result: Even with this significantly lower radiation, significantly more rats contracted cancer than in the comparison group that was not irradiated.

Researchers have thus shown that electromagnetic radiation in rats can cause cancer at doses that are considered safe today and can partly be compared with what typical mobile phone users absorb today. Nevertheless, ICNIRP, this powerful association that influences limit values worldwide with its recommendations, does not want to change its recommendations, says Eric van Rongen, chairman of ICNIRP:

"ICNIRP does not consider these two studies to be evidence that this type of electromagnetic radiation has a carcinogenic effect.

Requirement: Upgrading of radiation value

Van Rongen sees too many question marks: In the US study, for example, only rats that were exposed to the maximum dose were diagnosed with cancer; in the Italian study, on the other hand, even rats that were exposed to significantly less radiation were diagnosed with the disease - for ICNIRP only a contradiction, not a warning signal. Also in the US study rats from the control group, which were not irradiated at all, died amazingly early and thus had no opportunity at all to develop tumours.

The Swedish cancer researcher Lennart Hardell demands that high-frequency electromagnetic radiation be upgraded from "possibly carcinogenic" to "probably carcinogenic". ICNIRP boss van Rongen takes a completely different view:

"Oh, no. This is not the conclusion that ICNIRP drew from these studies. The only conclusion one can draw is that the situation is still unclear. This can only be solved with new, improved studies and more animals. The verdict is still pending."

Inge Paulini, President of the Federal Office for Radiation Protection, also relies on the ICNIRP main assessment:

"The limit values are set so that they start from the only proven effect of electromagnetic fields on our body, that is the thermal effect. There are no other effects that are proven to be below the limits."

The World Health Organization and the EU Commission also maintain that high-frequency electromagnetic radiation is only harmful if it additionally warms tissue by one degree.

Profiteers are companies. This international unity suits the industry best. The mobile phone giants are aware of the dangers of electromagnetic radiation and are warning investors against stricter limits. Vodafone, for example, writes in its 2017 annual report:

"Electromagnetic signals emitted by mobile devices and base stations can pose health risks, with potential consequences, including: changes in national legislation, a reduction in mobile phone use or legal disputes.

Deutsche Telekom also warns its shareholders that there is a "danger of regulatory intervention, such as lowering the limits for electromagnetic fields.

Why are the EU, the German government, large sections of the UN and many other industrialized countries so united in their view that only if the temperature rises by one degree does it become warmer will there be an additional risk? Why is there so little attention paid to research results with different names?

Critics say that this is because the EU, the UN and governments are given one-sided advice; that the relevant recommendations come from non-transparent research circles in which differing perspectives are not welcome.

A private organisation formulates recommendations

ICNIRP is at the centre of criticism. This association has managed to make this thermal effect the de facto standard of international organizations and very many states.

The private scientist association has only 13 members in the core, which it selects itself.

"ICNIRP depends on the out dated philosophy that only warming causes damage. They ignore and trivialize the health impairments that exist even without heat generation and that have clear effects", says Mr Victor Leach, of **ORSAA** an Australian non-governmental organization that advocates stricter radiation limits. "ICNIRP is a private organization with no public accountability and formulates one of the laxest protection recommendations in the world.

The ICNIRP Association is recognised by the UN as a consultant and its representatives are represented in all relevant bodies. ICNIRP has set guidelines that the WHO and the EU have adopted for limit values - and, in order to achieve harmonisation, all countries should act accordingly. David

Carpenter, Professor of Environmental Medicine at Albany University in New York State, along with other scientists, has warned WHO that ICNIRP ignores scientific literature.

"ICNIRP is a self-proclaimed body. Because people who want to join ICNIRP must support this erroneous concept that there are no adverse health effects if the tissue does not warm up. Why they have such an influence on governments and international institutions is a mystery to me."

In the EU, for example, the "Scientific Committee on New Health Risks" examines the state of science and recommends to the Commission what consequences should be drawn from any new findings. When the Committee was due to assess the dangers of radiofrequency electromagnetic radiation in 2015, four of the twelve members of ICNIRP were present. Result of the investigation: **No new findings.**

Also the World Health Organization of the UNO, the WHO, has a committee, which is to examine the dangers of the radiation, the EMF project. These days the experts are supposed to look there once again whether new scientific realizations require that the danger of electromagnetic radiation must be perhaps re-evaluated. The core group preparing the decision is made up of six experts, four of whom are ICNIRP members or closely associated with the association and have long since given their opinion on the research situation: Before tissue warms up, there are no health effects. There are no clear signs that non-ionising electromagnetic radiation is carcinogenic, says ICNIRP boss van Rongen:

"There are no clear and consistent indications that there is a carcinogenic effect."

Scientists with links to industry?

Eric van Rongen replied: ICNIRP members were only in the EMF core group, and a much larger committee would then vote on the assessment. But also in this committee there are obviously many people who are very attached to ICNIRP and its boss van Rongen. Mr Victor Leach of the radiation-critical non-governmental organisation **ORSAA** says that he has evaluated and looked at 3300 studies which could have been used by ICNIRP to support their position, so: Does the study come to the conclusion that high-frequency electromagnetic radiation have an "Effect:" on the organism before it gets warm, or does the study see "NO Effect" before the tissue gets warm? Victor Leach says "We found a very complex network. Many scientists who assess the health risks of electromagnetic radiation for the UN seem to have industrial connections and belong to the camp of those who do not see any radiation effects before the tissue gets warm. Many of the representatives in the crucial UN body have research relationships - direct or indirect - with ICNIRP chairman van Rongen or his representative."

Journalist Harald Schumann and his research network "Investigate Europe" have investigated which scientists are members of the decisive UN and EU committees:

"It is astonishing then nevertheless that of several hundred scientists, who see this thing substantially more skeptically, that all are not represented in these committees. There is a camp formation taking place and the one camp is more or less excluded from the decision making."

Four years ago, 220 radiation scientists wrote an appeal to the UNO to appoint an independent body to question the ICNIRP standard and reflect all scientific points of view. In the UN committees, researchers from countries that have introduced limit values 100 times lower than those propagated by ICNIRP are underrepresented, says Victor Leach of ORSAA: "Our analysis shows that the composition of the WHO Panel is inappropriate and unacceptable because the balance of evidence is distorted. ORSAA urges the WHO to reassign experts from various disciplines to the panel, especially cell biologists and clinical physicians."

But there is no sign that the committees are more balanced and that the power of ICNIRP is being questioned. On the contrary.

German government pays 100,000 euros per year to ICNIRP

The Federal Government is strangely linked to ICNIRP. The Federal Environment Ministry transfers 100,000 euros in tax money to the association every year. The scientific coordination for the private ICNIRP association is carried out by the head of the department for electromagnetic fields at the Federal Office for Radiation Protection. The previous head of the authorities department was even chairman of ICNIRP. The Federal Office for Radiation Protection also makes rooms available to the association in its Munich building - rent-free.

"Why does the Federal Office for Radiation Protection make rent-free rooms available to this association?"

Paulini: This is technical support that we provide. The secretariat has to be somewhere. We think international exchange is very important. The head of the Federal Office for Radiation Protection does not see any reason to appoint a more balanced ICNIRP or international committees:

Banse: "It is not only a scientist who says: This thermal effect, we doubt it. And none of them is in ICNIRP and only a minority is in the WHO Core Group. Is that unbalanced?"

Paulini: "The Federal Office for Radiation Protection comes to the conclusion, after really extensive and thorough research, that at the moment there is only the thermal effect."

Banse: "Nevertheless, shouldn't this point also be represented in ICNIRP by scientists who support this thesis?"

Paulini: "ICNIRP is an association that chooses its members by itself. I can't influence from the outside who is chosen."

But why does the office not establish its own commission, in which all scientific points of view are represented and whose members are appointed transparently?

Paulini: "Our impression, and our experience after a long cooperation with ICNIRP, is that this is a very serious association, that this is a serious science that is being carried out and that the recommendations are quite substantial. And the cooperation with ICNIRP is an essential part of the overall recommendation that we then compile".

At the moment there is no sign of stricter limits - not least because the WHO, the EU and Germany continue to believe that high-frequency electromagnetic radiation poses no danger before tissue does not warm up significantly. However, with the development of the new 5G mobile radio network, things are changing - at least in the long term.

Because 5G transmits on other, higher frequencies than today's mobile radio standards. What does that mean? A little physics again:

Frequency means: How fast does one wave oscillate per second? Here the connection applies: the higher the frequency, the more data can be transmitted, but the stronger the wave is damped or braked. From walls, for example, or from human tissue. This is why 5G masts, which transmit at higher frequencies than current mobile radio systems, have a shorter range than today's mobile radio masts. This is why 5G rays do not penetrate so deeply into our bodies and their energy is absorbed at the surface of the skin.

However, the Swiss research foundation IT'IS has already proven this: At future 5G frequencies above ten gigahertz, tissue damage can occur at short distances even at permitted transmission powers. The head of the Federal Office for Radiation Protection insists that how the body reacts to these higher frequencies - especially in the long term - is unknown:

"There is no broad knowledge base for these possible effects. Many years ago, in the German Mobile Telecommunication Research Programme, we investigated the frequencies that we wanted to use and the bands that went beyond them. We have not yet investigated these high frequencies. It is now a question of completeness that we look at this."

According to the EU Treaty, citizens must be protected

The studies should be available in two to three years. But 5G has other new properties whose effects have not yet been researched. The antennas, for example, no longer radiate 360 degrees around the mast, but 5G antennas

bundle beams into "clubs" in order to reach those who are currently telephoning or receiving data. Whether the radiation exposure will increase through 5G is unclear, says the head of the Federal Office for Radiation Protection:

"You can't say more or less. The question is a bit more complex. It will be different. And we have to see if there will be more in some places."

"The bottom line is that there is a high scientific uncertainty about the health risks associated with this mobile radiation."

Says journalist Harald Schumann. How we should deal with such uncertainty is stated in Article 191 of the current EU Treaty:

"The Union's environmental policy is based on the principles of precaution and prevention.

Citizens in Europe must in principle be protected from products whose safety has not yet been proven. This is also demanded by more than 400 scientists in an appeal to the UN, the EU and all states. One of them is the physicist Ernst Ulrich von Weizsäcker:

"I signed it because I thought the precautionary principle had to be applied. That means looking carefully at major innovations. Where are the problems?"

But this precautionary principle is not applied to high-frequency electromagnetic radiation such as mobile radio.

Switzerland shows that there's another way

The head of cabinet of acting EU health commissioner Vytenis Andriukaitis writes in a letter to protesting scientists, quote:

"The use of the precautionary principle to stop the distribution of 5G technology seems too drastic a measure.

The EU wants to wait and see how 5G technology is applied and how scientific evidence develops. Switzerland has a different idea of the precautionary principle. The Swiss Federal Office for the Environment has the effects of mobile phone radiation investigated, but the Swiss government has already acted, as a precaution, writes the Swiss environmental authority:

"The Federal Council could not wait for science to provide the desired answers. The precautionary principle of the Environmental Protection Act requires that the pollution should be as low as technically possible.

The German Federal Office for Radiation Protection sees precaution as something different. Stricter limit values do not automatically mean better protection, says President Paulini. Because the higher limit values that apply in Germany are often not exhausted in everyday life.

"The Federal Office for Radiation Protection always advocates that 5G should be carefully expanded. This means that we should not set up the entire network without checking intermediate steps. But that is not planned either."

The 5G frequencies up to 3.7 gigahertz are currently being auctioned off. But 5G can also transmit on much higher frequencies, far beyond 20 gigahertz. It has not yet been determined whether this will happen, says the President of the Federal Office for Radiation Protection:

"We are going there for precautionary reasons and say that we still want to undertake impact studies in this area. That is now also planned and some of them are still starting this year".

The long-term consequences are completely unexplained

So humans are exposed to more and more electromagnetic radiation and that is likely to increase. Whether, for example, mobile radio radiation can harm people or even cause cancer within the current limits is controversial. The long-term effects of electromagnetic radiation on humans, for example, are completely unexplained.

And there are more and more studies questioning which method Germany and the EU use to set their limit values. The critics of this thermal effect are, however, underrepresented in the decisive committees. These important expert commissions must be put together in a more transparent, democratic and balanced manner.

Only in this way can a society find an accepted path between health risk and technical progress. And without state support and precaution, citizens can hardly protect themselves against electromagnetic radiation - the spokeswoman of the Federal Office for Radiation Protection, Nicole Meßmer:

"This is the reason why we always say: Use your mobile phone prudently, don't make phone calls when reception is poor, use your headset and don't spend hours on your ear making phone calls, because you really can't say anything about these long-term consequences.