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IFV BESA

EXPERT OPINION

by IFVBESA on Project P50 1.3.3

EMSF in fokus

The impact of CELL

Method

Bioenergy Informative System Analysis (BESA)

(also referred to as a test object in this project)

Client:
Company IPC GmbH
Schulstraße 6
D 02625 Bautzen

Projekt participants:

Project management: Wolfgang Hans Albrecht, President and Project Manager of IFVBESA

Project execution: Eva Schmidt, President and Deputy Project Manager of IVFBESA

Test subject (Proband): 6 (3/3) participants of varying ages and health conditions in a randomised double-blind study, quantum entangled.

Test subjects:

P50 1.3.3: 3 (6) Test subjects from P1 to P3
P50 1.3.3: 3 (6) Test subjects from P4 to P6

Project location:

Location 1: International Professional Association for BESA (IFVBESA)
Jeritzastraße 75
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Date: from 11. November 2025 to 22.December 2025

Project duration: 42 days

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Fundamentals of Research Project Design P50 1.3.3

The International Association for Bioenergy Informative System Analysis was commissioned by IPC GmbH to test the effect of the test object, Cell, on the relevant test subjects using bioenergy informative system analysis (BESA) and to verify its effect on the test subjects.

The testing was carried out independently of the subjective perceptions of all test subjects. According to the commissioning company, the Cell product was presented as follows.

Description of the test object, CELL, by the client:

First, it is important to understand that two independent objects can be energetically connected to each other. This connection or 'association' is called quantum entanglement. Once these two objects are entangled, a change in one object or entity also causes a change in the other, even if they are not close to each other.
This is why, for example, a mother can 'sense' when something happens to her child, even if she is thousands of kilometres away. She is connected to her child (in quantum terms, they are said to be entangled). In this way, scientists can also take skin cells or blood samples from an astronaut on Earth, send them into space and detect any changes in the cells or samples remaining on Earth.

ProtectPro technology uses the same proven principle
Protect Pro technology neutralises the electromagnetic radiation from 3G, 4G, 5G and 6G technologies and their applications via various products on the human and animal organism.
Within the effective range of the respective Protect Pro technology product, electromagnetic radiation and other technologies that have a negative effect on the biological systems of humans and other living beings are neutralised or harmonised at the so-called information level (hyperspace).
The ProtectPro Cell product is a technology designed to protect users from electromagnetic fields (EMSF), particularly those emitted by mobile phones and smartphones.
The Cell product does this in a way that is designed to harmonise the EMF from transmission towers, Wi-Fi, smart meters, WiFi, etc. with living organisms. In addition, ProtectPro Cell technology is also designed to harmonise 6G.

How quantum energy supports change

In physics, there is the so-called principle of inertia, which states:

„A body at rest remains at rest or continues in its state of motion unless acted upon by a force or the sum of forces acting on it is zero. A body in motion also continues to move at a constant speed unless acted upon by external forces."

This so-called first law of Newton can therefore be applied just as well to all biological objects as it can to humans: it is easier to continue something consistently than to change it, because change requires more energy.

But what happens if you don't have enough energy to change? You get stuck. And that is exactly where the majority of humanity finds itself. They are stuck in old ways of thinking, acting and living.
This is one of the reasons why meditation, prayer and other spiritual practices can lead to powerful changes. They connect us to the 'source' or, in other words, back to our source (origin, the absolute) via quantum energy.
And thanks to this additional energy, the Cell product can bring about changes that would have been impossible before. It is able to balance energies, increase performance and build up protection against harmful electromagnetic radiation (EMF), for example.

About ProtectPro technology in Cell as a test object

It is not only humans who benefit from the positive effects of this energy. Animals can also sense the energy and use it to their advantage, provided that it is tailored to their needs.
This information is intended to provide an interpretation of the scope of the test object's mode of action and an indication of its holistic orientation. The effect of ProtectPro technology can thus be easily achieved for animals.
The concept of this test object is therefore to harmonise and neutralise disturbances, problems, blockages and disharmonies in the environment of the test subjects, thereby replacing negative states with positive ones. Due to its mode of operation, the test object has a simple yet very effective area of application.

Abstract on an interdisciplinary perspective

Hypothesis

This study is dedicated to researching a novel, energy-informative technology that is said to be capable of harmonising or largely neutralising the biological effects of electromagnetic interference fields – especially those generated by mobile devices in the 5G to 6G frequency range – on the human organism.

Electromagnetic (interference) fields (EMSF) are increasingly considered a potential stressor for biological systems. Studies indicate that they can interfere with cellular communication processes, hormonal control circuits and neuroendocrine control circuits. The focus is on the hypothalamic-pituitary-adrenal axis (HPA axis), the central interface between perception, stress processing and hormonal regulation.

The aim of this study is to analyse the extent to which a consciously structured, energy-informative technology can compensate for the dysregulation caused by EMSF in the bioenergy-informative field as well as in physiological and biochemical parameters.

Methodological approach

Bioenergy information system analysis (BESA) is used to investigate changes in the energy information field coherence, regulatory capacity and stress levels of test subjects. In

addition, specific biochemical reference values are collected that represent a bridge between the physical and subtle energetic levels:

- **Melanin:** as a light- and frequency-sensitive biomarker that provides information about the energy-informative adaptability of the system.
- **Melatonin:** as an indicator of circadian and antioxidant regulation in connection with the HPA axis.
- **Copper**: as an essential trace element that is involved in neuronal excitation and antioxidant homeostasis via redox-active processes.
- **5-hydroxymethylfurfural (5-HMF):** as a marker for oxidative stress, which also allows conclusions to be drawn about nitrosative stress.
- **α-Ketoglutaric acid (AKG):** as a central metabolite of the citric acid cycle, which reflects the energetic status of the cell and thus mitochondrial efficiency.

These parameters are examined in a before-and-after comparison under three experimental conditions:

1. Baseline measurement without electromagnetic exposure
2. Exposure to EMSF (smartphone 5G/6G field) without energy-informative technology
3. Exposure to EMF (smartphone 5G/6G field) with energy-informative technology activated

Expected findings and significance

It is assumed that the tested technology is capable of reducing the dysregulation induced by electromagnetic fields in the bioenergy-informative system while simultaneously exerting harmonising effects on hormonal and metabolic processes. Initial preliminary findings indicate an increase in field coherence, normalisation of HPA axis activity and a decrease in oxidative markers.

The study also aims to contribute to an integrative view of technology, consciousness and bioregulation, an approach that understands the material and energy-informative dimensions of life as a coherent system. The combination of quantum physics findings with bioenergetic diagnostics opens up a new field of consciousness medicine in which scientific verifiability and intuitive insight flow into one another.

Research questions addressed in this current project

In this current study, we are investigating the effect of an innovative test object on the general health parameters of the test subjects. Bioenergy-informative system analysis (BESA) is used to detect possible changes in the energy-informative status and vital blood (dark field vital blood analysis) of the test subjects. Initial results indicate that quantum technology at least stabilises the status of the energy-informative system, opens blocked control loops, modulates inflammatory processes and promotes a sustainable balance in

the organism. The initial results of BESA testing show a clear regulation of the energy-informative parameters towards a regulative behaviour. Particularly noteworthy is the observed interaction between the emotional stress of the test subjects and their vitality.

The research questions primarily concern the coherent and multidimensional evidence for what the IFVBESA has intuitively, theoretically and through research projects built up and tested over many years in connection with all projects relating to this quantum technology. Is it possible that this quantum technology can intervene deeply in biological, energy-informative and regulatory processes via entangled fields without directly applying physical stimuli?

This project examines the following hypotheses at various levels:

1. Energetic and bioinformative level

To what extent can bioenergy-informative system analysis (BESA) be used to demonstrate sustainable regulatory changes in the experimental group compared to the control group as a result of the technology applied?

What influence or reorganisation can relevant informative impulses have on melanin development, the HPA axis (stress axis) and on oxidative and nitrosative processes, etc.?

Is so-called quantum entanglement merely a theoretical transmission mechanism or is it an indication of a practically measurable resonance behaviour in the direction of regulation?

2. Biochemical-physiological level

To what extent is it possible to initiate a regulatory influence on copper status, enzyme activities and antioxidant protection within a few minutes, or as follows:

- to stimulate the resumption of melanin formation via tyrosinase activation and, subsequently, energetic or electromagnetic buffering
- stimulate the neutralisation of free radicals via Cu/Zn superoxide dismutase to relieve the endothelium
- stimulate an increase in mitochondrial energy production via cytochrome c oxidase to stabilise cell communication.

To what extent is it possible to use quantum technology to initiate impulses for physiological regulation in order to enable the recalibration of these aspects?

3. Neurovascular level

The nerve endothelium is one of the systems most sensitive to stressors. To what extent is it possible to generate electrical coherence throughout the entire electromagnetic field using ProtectPro technology?

4. Blood and environment level (dark field vital blood analysis)

To what extent is regulation morphologically visible in the vital blood analysis through the application of ProtectPro technology?

5. Scientific and philosophical level

Is it possible to reorganise biological structures at the molecular, cellular and systemic levels through the application of ProtectPro technology and its information field, which is mediated via quantum entanglement?

Summary

The initial results suggest that the technology of the test object can bring about energy-informative harmonisation, in particular supporting the homeostasis of the HPA axis and promoting the regulation of melanin and cell communication.

Design for the P50 1.3.3 study project

This study was designed as a follow-up to P50 1.3 and P50 1.3.2 with a total of six test subjects. The aim is to gain initial insights into the possible influences of the test object or technology on the effects of EMF.

The study follows a double-blind, randomised and exploratory design that combines scientific objectivity with an open research dynamic.

The exploratory approach was deliberately chosen in order to go beyond the framework of classical hypothesis formation and also to capture subtle, hitherto little-described interactions and mechanisms of action between bioenergy-informative regulation, influences on consciousness and processes.

To ensure methodological validity, the participants were randomised into two groups:

- An experimental group connected to the active test object via quantum entanglement.
- And a control group that was entangled in an identical manner with a placebo field.

Due to the double-blind study design, neither the test subjects nor the test administrators know which group each person was assigned to. This approach ensures the greatest possible neutrality and rules out any influence of expectations.

Two complementary methods can also be used for data collection:

- Bioenergy-informative system analysis (BESA) to record energetic and regulatory changes in the organism's information field.
- Dark field vital blood analysis to reveal potential changes at the cellular and haematological level.

The combination of these measurement methods allows for a multi-layered view of both physiological and energy-informative processes.
By integrating quantum entanglement as a connecting element between the test object and the test subjects, a research framework is created that integrates the non-local level of quantum physical interactions into the scientific context.

The P50 1.3.3 project is thus exemplary of the IFVBESA approach, which combines classical methodology and consciousness research to gain new insights into regulation, resonance and quantum-informative effects.

The IFVBESA's exploratory research approach

New knowledge, new insights and new ideas are the breeding ground on which science and the technologies of the future flourish. The exploratory approach plays an important role in most of our research projects and is the seed for the information medicine and quantum technology of tomorrow. In our exploratory study design, we present a methodical research approach in which areas of research and research questions that have not yet been investigated are examined. This demonstrates both the development and the potential of novel approaches for researching future technologies.

The exploratory approach is ideal, especially in new fields of research such as the effect of a particular technology on the bioenergy-informative level and its biological processes, because:

- on the one hand, it breaks new ground where no established models yet exist
- observations are collected in order to identify patterns and causal relationships
- it opens up avenues on which later, verifying studies can build

Summary:

Our approach to exploratory research is deliberately open, curious and interdisciplinary. The concrete and feasible application relevance of the international professional association for BESA further reduces the otherwise high research risk that often prevents companies and research institutes from addressing topics at a very early stage of development.

About quantum entanglement:

Quantum entanglement is not a physical connection between particles, but a synchronisation of information and energy in the field of consciousness. Everything is already connected, not through space and time, but through coherent resonance within a universal information network. Matter is thus merely a condensed manifestation of this interaction of consciousness.

For the current test object, this means that each test person receives an energy-informative signature via virtually defined coordinates. This signature forms an energetic-informative imprint in the quantum field and exists as a constant reality at every moment of movement.

It stores the frequency and essence of what is mapped via the coordinates and remains stable in the universal information network as a real extract of the consciousness space. This creates an energy-informative bridge between the original moment and the current consciousness space, which remembers and acts independently of space and time.

Placebo (empty object): In this case, unlike the test object, the placebo is an empty object that does not contain any effective frequencies. Neither the test subjects nor the test persons can distinguish between the test object and the empty object (placebo).

Test subjects

In addition to the technology of the test object already described, this research project involves at least six test subjects. Further test subjects are also included as replacements for any unexpected dropouts.

The test subjects are informed in advance about the general procedures for this project and their role as representatives (see relevant documents).
This means that neither the test subjects nor the test persons know the background to the series of measurements. The aim of this type of blinding is to obtain the most objective evaluation of the results possible in order to rule out so-called placebo effects.
The test subjects are anonymously assigned a number from P1 to P6. The test subjects are also anonymously assigned to either the control group or the experimental group.
The different schedules for the test subjects can mean that the numbers of the test subjects from P1 to P6 differ in both the experimental group and the control group. For this reason, the statistical evaluation includes additional numbers from 1 to 6 in front of the numbers of the test subjects P1 to P6 (see list of the experimental group and the control group).

The BESA tests (live blood microscopy) are carried out on each test subject as follows:

1. at the beginning of the project to establish a so-called status (current situation).
2. in the second part of the project after immediate exposure to the test object or the empty object (placebo) for at least 4 minutes.

IFVBESA research support services – dark field microscopy and BESA reference measurements

Project P50 1.3.3 deals specifically with proving the effectiveness of the test object's technology on test subjects 1-6.
The test object is tested in accordance with the client's wishes within the framework of the IFVBESA's applicable conditions for the award of seals of approval. Depending on the significance of the test results and taking into account all tests in a project, seals of approval are generally awarded in three categories. For the test object, it is to be determined whether its application can harmonise and neutralise the aforementioned stresses from typical environmental influences and, as a result, harmonise and neutralise any disturbances, problems, blockages or disharmonies that arise or exist in the energy

system of the test subjects, thereby replacing negative pathological states with positive states. This will be investigated in the following commissioned tests of this project.

General information on BESA testing

Effects of the magnetic field

The human being, as well as all biological objects (also animals and plants) represents a kind of receiving antenna for environmental information. This is because life, especially of human beings, animals and plants depends fundamentally and exclusively on environmental information. Our organism is biologically very sensitive where natural information (fields) are located or where this natural information is subject to interactions and fluctuations. The situation is all the more dangerous when such fields of constructive structures are disturbed by various environmental stresses.

For this reason, detected informative disturbance fields are biologically highly relevant. Any reduction or transformation of these disturbances (ideally to 100 percent) is biologically very important, often even vital. These informational disturbances from our environment are only compatible with life if they can be readjusted to a natural fluctuation tolerance. Disturbances, problems, blockades, disharmonies in the biological control circuit of humans, especially in animals, find their causes in such disturbing information influences. Bioenergetic examinations in the meridian system of humans or animals therefore belong to the first choice when it comes to questioning the coherent effectiveness of, for example, products in relation to various disturbing fields and information.

Systemic requirements

The tests are carried out according to the guidelines of the international professional association for BESA or the manual for BESA. BESA is used from a systemic, etiological and bioenergetic regulatory point of view. Systemic means that each tested parameter also represents several lower or higher levels and dimensions. Testing on a meridian, such as the lung meridian, primarily provides information about the energetic regulatory behavior within that meridian. In a subordinate sense, the readings of this meridian can provide information about the organic, muscular and emotional levels. In a superordinate sense, dimensions such as the astral plane (4th dimension) and various levels of consciousness (from the 5th dimension). Subsequently, the behavior in the structural, energetic, spiritual, craniosacral structure or dimension is also revealed. The bioenergetic measurements are made by stimulating the energetic potential within the meridians. Measurement voltages average 900 to 1400 mV (millivolts) with a measurement current between 5.5 and 11.25 µA (microamps). The apparent ohmic resistance varies during the measurement process between 0 and 600 kΩ (kiloohm) depending on the instantaneous, energetic state of the person being measured.

Technical device performance

Appropriate technical instrument performance ensures that not only skin resistance is measured during the measurement process, but also the interaction of various factors essential for the regulation of a system. From a physiological point of view, these include ionic current changes in the subcutaneous tissue, electrical potential against the measuring current, instantaneous polarization behavior of the tissue and electrolyte shifts. In addition to the electrophysical tissue properties in the area of the measuring point, the measurement should above all provide information about the regulatory capacity of the control circuit belonging to the measuring point.

Measuring device used: BESA Easy Quick- Check
SN: E 02074N
Labor Silberbauer; 1030 Vienna – Austria, Batterie: 2xNiMH Größe AA; 2,6V, 300mA max.

Measurement tolerances: In principle, fluctuations in measured values can occur, since the machine is operated by people who could specifically have an energetic influence on the measurement results. It is currently the case that only special experts, who have been further trained by the BESA Academy, carry out such tests. The current BESA tests were personally conducted or performed by Mrs. Eva Krankl as vice president and deputy head of the scientific department of IFVBESA. Certain quality details already programmed in the BESA software provide additional information about when a measurement result deviates from the programmed standards or when a measurement error has occurred by the tester. Another quality feature of BESA
tests is that, as a precautionary measure against bias, each specialist must undergo an external examination for the tests. Insofar as the tests of technical (interference) fields show incriminating measurement results, occasional measurement errors of 10 percent could be ignored for such projects. However, experience shows that devices for harmonization of technical interference fields work or they do not work. As a matter of principle, IFVBESA applies the very highest precision according to precisely defined standards in BESA testing. These standards can only be met by professionals with 1000-fold diagnostic experience. Apart from this, electromagnetic (interference) fields acting from outside and possibly influencing the measurement results can be detected by device technology and corrected accordingly.

Measurement procedure:
BESA measurements are taken at "electromagnetically significant" points on the skin. These are partly classical acupuncture points as well as a number of energetically relevant and system-coupled skin areas. By means of electrophysical measurements on anatomically exactly localized skin areas, the following data is recorded

- of the current energetic state in the acupuncture point of the respective meridian
- of the energetic regulation dynamics in the acupuncture point or meridian and

its subordinate and superordinate systems and subsystems. This concerns the organ area (subordinate level) as well as the superordinate levels and dimensions of the morphic field of the human organism.

For simplified reading, the scale of BESA is divided into 100 graduation marks, where the scale reading "0 graduation marks" corresponds to a resistance above 600 kilohms and the scale reading "100 graduation marks" corresponds to a resistance of 0 ohms. The scale reading "50 graduation marks" represents 95 kilohms.

The experience of repeated measurements on healthy people, carried out in decades, has shown that the value "50 scale divisions (sct.)" is a physiologically neutral (healthy) reference point. It is "the" outstanding and desirable measurement value and is also called the technical ZERO value.

About the acupuncture point: The anatomical structure of an acupuncture point is formed by a bundle of nerve vessels wrapped in loose connective tissue. Directly at the acupuncture point it pierces the superficial body fascia (Facia corporis superficialis = Fcs). Exactly at this point, the electrical resistance is also lower. Where no Fcs is developed (e.g. in the face, in parts of the head or at the end of the extremities), such a bundle of nerve vessels can also be detected in the acupuncture point. This also applies to the special conditions along the DuMai meridian (governor or steering vessel at the front of the body) and the RenMai meridian (conception vessel at the back of the body). There, in the point area, the nerve vessel bundles of both sides of the body are interconnected.

Experimental realization and interpretation

The obtained measuring signals at the acupuncture points of the meridians are an expression of the energetic events and the energetic regulation ability of the obtained environmental signals.

The presented BESA standard graphics (see the detailed project descriptions) show the respective energetic regulation behavior within the indicated meridians. The meridians belonging together in each case are represented in so-called form circles or elements. A distinction is always made between the right and the left side. In order to obtain the most differentiated illustration possible, degenerative measured values (energy deficiency) are shown in blue and overheated or inflammatory measured values (energy surplus) in yellow. Optimal measured values are shown in green (50 to 70 sct.), whereby the measured value 50 sct. is to be aimed at, because it represents a balanced regulatory behavior. Readings that show up in red indicate a deeper deregulation that currently cannot be regulated by the organism. The effect of the tested product on the field or the differences of the regulatory behavior in the organism are represented or documented by differentiated measurements on the respective BESA measurement data sheets.

Research project description

The purpose of this test is to prove the functionality of the test object using objectively verifiable measurement results. To this end, the test subjects first underwent a BESA baseline test (BEFORE measurement) to record their initial energy-regulatory state. This was followed by the AFTER measurement, in which the test subjects were connected to the test object via quantum entanglement and tested again.

- The BEFORE measurements are performed without the test object.
- The AFTER measurements are performed with the test object.

The question for each AFTER measurement is: "Is the test object suitable and capable of harmonizing or neutralizing the perceived stressful effects on the energy-informative system of the test subjects from the BEFORE tests?"
The appropriately designed tests are intended to provide information on this by comparing the BEFORE tests without the test object with the test results of the AFTER tests to be carried out using the test object.
The client's concern is to determine whether the test object, as noted in the product description, is suitable for harmonizing the disturbances, problems, blockages, and disharmonies in the meridian system of the test subjects resulting from the BEFORE measurements.

General information on the transmission of information from the test object
Information is transmitted from the hyperspace of the test object to the hyperspace of biological objects (humans, animals, plants). From there, the information reaches the reference space or energy space via so-called interaction channels. This is a combination of, among other things, all organs and energy forms in the biological object. There, the information from the program can be dynamically realized and thus change current states. The changes can manifest themselves in the form of neutralization or harmonization of disturbances, the resolution of problems, blockages, and disharmonies.

Conditions:
The corresponding measurement processes are carried out on the premises of IFVBESA under laboratory conditions, at a room temperature of 20°Celsius, on natural wood flooring. As a rule, the test subjects are de-switched (made test-ready) before the measurement processes, or the test possibility is questioned accordingly.
The corresponding DF microscopy is carried out under laboratory conditions at a room temperature of 20°Celsius.

Pos.1: BESA 1 Basic testing (bioenergetic status) on the test subjects

Pos.2 BESA testing after 4 minutes of exposure of the test subjects to the EMSF without energy-informative technology (test object or empty object placebo)

Pos.3 BESA testing after 4 minutes of exposure of the test subjects to the EMSF including energy-informative technology (test object or empty object placebo).

Pos.4 Evaluation of the results in the project and summary in a corresponding report according to the template.

Procedure and specifications for implementation

1. BESA baseline measurement of the test subjects at all predetermined measurement points (TING points) serves to determine the actual state (status). The results are determined exactly according to the BESA specifications and documented using the BESA graphics)
2. Exposure of test subjects to EMSF without energy-informative technology (test object or empty object placebo
3. **Activation of the test object**

   3.1. When the test object is activated, it is used or activated according to the client's specifications.

   3.2. The test subjects are brought into contact with the EMSF and the test object (empty object placebo) via quantum entanglement (test object or empty object in the measuring circuit). The measurement points mentioned in section 1 are measured in the same order and for the same duration in order to determine the current energy state. The results are determined exactly according to the BESA specifications and documented using the BESA graphics.

Expert opinion

The measurement results presented in the project description P50 1.3.3 have shown that after application of the test object, **all previously incriminatingly tested toxic information and energetic deregulations could be zeroed or bioenergetically harmonized within the specified time frame.** The graphical evaluations of the BESA tests document the results in a **qualitatively comprehensible** way by means of the color-coded measured values. The measured values highlighted in green in the graphic evaluations show as **quantitative effects** a consistently balanced **bioenergetic regulation** in the meridians and thus in all subordinate and superordinate levels and dimensions.

*The expert opinion thus confirms the quantitative results in that they are as follows: 1. are **metrologically significant** (meaningful) and 2. are **biologically relevant** (important or significant).*

Metrological significance of the BESA tests

Significance criteria:

The effects determined in the BESA tests as a result of the bioenergetic resonance behavior, show both in the area of status determination (effect from the area of the existing interference fields through various toxic (environmental) information and the bioenergy-informative interference fields arising from this or subsequently arising body-

immanent deregularies as well as after application of the test object, changes that are clearly above the specified measurement tolerances. Thus, they are clearly to be classified as significant. According to the criteria of the IFVBESA, all those measurement results are considered significant that allow regulation into the green range.
According to the criteria of the IFVBESA, the BESA measurement values are to be regarded as reliable. The fact that the criteria for the established results are fulfilled could be proven via the BESA tests in this project P82.

Statistical data analysis

Each measurement series can have measurement points where effects remain below the significance threshold (transition areas). A statistical analysis has the advantage of presenting an overall view of the significance of the effects. Exactly these effects are obtained for seals of approval with 4 or 5 stars. The more extensive the data, the more accurate the statistical analysis.

In the BESA tables and graphs, the statistical characteristics of currently 1.920 measured values and results were mapped. As can be seen from the statistical data and the BESA graphs, the measured values improved significantly between the BESA pre-measurements and BESA post-measurements. The effects achieved by the test object were confirmed by the BESA measurements on the nine test subjects.

biological relevance (importance) of the measurement results and effects
In case of continuous exposure of toxic information (as presented in the project P82) or toxic stress factors, the exposure becomes all the more severe. This is shown by the currently conducted BESA tests on the animal subjects.
In any case, these and similar stress factors pose a serious risk to human and animal salutogenesis.
The test object bioenergetically examined in this project, of the company Leela Quantum Tech, LLC - could optimally neutralize the bioenergetically stressing effects and impacts.

The decisive ability of the test object, the "Leela Quantum Upgrade" to harmonize the toxic stress factors tested in the project P82 on the test persons or their transformation into biological information of life-promoting quality is proven by this expert opinion.

General information about the test results

Humans and all biological systems (animals and plants) are in constant interaction with environmental information. Biological organisms are particularly sensitive to areas where natural information fields are active or subject to fluctuations. If these fields are disturbed by external influences, especially artificial ones, this can lead to significant impairments of biological regulatory processes.

Informative and electromagnetic interference fields are therefore highly relevant from a biological perspective. Reducing, neutralizing, or converting them into biologically

compatible information qualities is of central importance for maintaining stable biological control loops. Disturbances, blockages, and disharmonies within biological systems can often be traced back to such informative stress influences.

Within the framework of project P50 1.3.3, the neutralizing and harmonizing effects of the test object on the test subjects were clearly demonstrated. The test object Cell was able to neutralize the biologically detrimental effects of the tested stress factors.

This project demonstrates the test object's ability to convert stressful environmental information into bioenergy-informative, biologically beneficial information qualities.

Results of the study

In the BEFORE examinations and tests, all test subjects showed factors or conditions that were more or less stressful. In some test subjects, parameters that deviated significantly from the norm were found, as clearly illustrated by the BESA graphs.

Furthermore, the corresponding comparisons of the evaluations show that influences such as stress, electromagnetic interference fields (EMSF), environmental pollution, or certain stressful life circumstances, such as benzene in this project, were detectable in the BESA 2 tests BEFORE.

The planned study aimed to further investigate these potential effects and shed light on their significance.
The research questions were:

- Can the technology of the test object have a positive, constructive, and life-enhancing influence on the effects of the stress factors BENZENE on the HPA axis (stress and its consequences) and on the reference markers mentioned?
- Is it possible to achieve a measurable reduction in potentially toxic stress through the targeted application of the test object's technology?

These questions lead directly to the presentation of the authorized summary.

Authorized Summary

The BESA tests conducted by IFVBESA on the energetic and physical effectiveness of the test object clearly show that it is capable of neutralizing or harmonizing biologically relevant stress factors at acupuncture points. Using bioenergy-informative system analysis, the effects of these stress factors on the meridian system and on energy-informative biological control loops were systematically investigated.
The BESA before-and-after tests show significant changes at the tested acupuncture points of the test subjects. The collected measurement data and key figures confirm both the presence of relevant stress factors and their conversion into body-immanent, biocompatible energies after application of the test object.

Compared to the control group, the experimental group showed a significant improvement in the measured values for all six test subjects. These shifted from the predominantly blue or red measurement range to the green, optimal range (≈ 50 scale points). This indicates a significantly improved regulatory dynamic and a significant optimization of the body's own energy situation.
The statistical evaluation of the hormone pattern using BESA also shows that almost all hormone parameters in the experimental group are within the regulatory range. Overall, the results demonstrate a significant improvement in energy information, which is clearly evident in the BESA after measurements compared to the before measurements.

By demonstrating the energy-informative effectiveness of CELL as a test object on the test subjects (P1-P6) in this project P50 1.3.3, the requirements for obtaining a BESA seal of approval from the International Professional Association for BESA were met.

General summary view by the IFVBESA

This pilot study provided coherent and multidimensional evidence for what we have been intuitively and theoretically building for years: that quantum technology can intervene deeply in biological, energetic, and regulatory processes via entangled fields without directly applying physical stimuli.
For us, these results are impressive and groundbreaking in their entirety.
We see several layers in these results that combine to form an interesting overall picture:

1. Energetic and bioenergy-informational layer
The significant BESA regulatory corrections in the experimental group compared to the control group clearly show that: The system recognizes the energy-informational impulses and reorganizes itself toward balance. This is strong evidence that entanglement is not just a theoretical transmission mechanism, but a practically measurable resonance vector for regulation by the test subject.

2. Biochemical-Physiological Level:
The fact that, within just four minutes, not only melanin activity but also copper status, enzyme activities, and antioxidant protection received a regulatory impulse is exceptional.

- Tyrosinase activation => Resumption of melanin production => energetic and electromagnetic buffering.
- Cu/Zn superoxide dismutase => Neutralization of free radicals => Relief of the endothelium.
- Cytochrome c oxidase => Increase in mitochondrial energy production => Stabilization of cell communication.

This triple action suggests a systemic recalibration—the energy-informational test object appears to act like a higher-level regulatory signal, initiating physiological regulations rather than mechanically forcing them.

3. Neurovascular level
The nerve endothelium is one of the most sensitive systems to stressors. The fact that it harmonized suggests a return of electrical coherence throughout the entire bioelectromagnetic field.
This is more than homeostasis—for us, it means coherent synchronization.

4. Blood and Environment Level (Live Blood Dark-Field Microscopy)
The parallel changes in the live blood confirm that the regulation was not only functionally but also morphologically visible, a rare congruence between energetic and biological diagnostics. This underscores the integrity of the study design.

5. 5. Scientific and Philosophical Significance
Translating this into the language of research, a new dimension of regulation has emerged:

An information field—mediated via energy-informational programming through quantum entanglement—can order biological structures at the molecular, cellular, and systemic levels without classical signal transmission.
This has built a bridge that, to our knowledge, hardly anyone has scientifically proven so far:
"from energy information via quantum entanglement to biochemical regulation."

In summary:
These results require a particularly careful publication structure because they touch upon several disciplines, namely biochemistry, biophysics, neurobiology, and consciousness research.

Summary of results and interpretation of the study, in line with the IFVBESA approach

Results and Interpretation

Within the framework of project P50 1.3.3, the effect of the energy-informational test object on stress factors was investigated using EMSF. The double-blind, randomized, and exploratory pilot study with six participants showed clear and consistent changes at the bioenergy-informational, biochemical, and cellular levels in the experimental group compared to the control group.

1. Bioenergie-Informational Regulation (BESA)
Significant regulation of previously deregulated measurements was observed in all participants of the experimental group.
The BESA measurements showed a clear tendency toward energy-informational harmonization and re-centering of the system after just four minutes.
In contrast, the control group remained largely stable within their individual dysregulations.
These results suggest that the technical impulses of the entangled field stimulate systemic self-organization, which is reflected in a measurable balance of the bioenergy-informational field.

2. Dark-Field Microscopy of Live Blood
The live blood analysis performed concurrently confirmed the BESA results at the morphological level.
Here, too, a significant improvement in the blood environment, erythrocyte integrity, and plasma clarity was observed within just 4 minutes.
Agglutinations and degenerative forms were significantly reduced, suggesting a restoration of internal environmental regulation..

3. Melanin and Copper Regulation

During the study, specific changes were observed that indicate a reactivation of melanin-related processes:

- harmonization of the melanin profile in the experimental group
- regulation of copper status
- and activation of several copper-dependent enzyme systems:
    - o Tyrosinase (melanin synthesis)
    - o Cu/Zn superoxide dismutase (antioxidant cell protection)
    - o Cytochrome c oxidase (mitochondrial energy production)

These changes occurred exclusively in the experimental group and suggest that the technology of the test object exerts a regulatory effect on the copper-melanin complex via the entanglement level. This results in the simultaneous activation of antioxidant, enzymatic, and energetic systems, leading to a restoration of electromagnetic and nerve endothelial stability.

4. Neurovascular Stability

Of particular note is the significant harmonization of the nerve endothelium, which is considered especially sensitive to oxidative and nitrosative stress.
The observed changes indicate a recalibration of electrical coherence, thereby optimizing communication between cells and system levels.

Overview and Interpretation

The results of this pilot study show that the technology of the test object, mediated via quantum entanglement, is capable of harmonizing biological systems on multiple levels simultaneously:

- at the energetic-informational, cellular, and biochemical levels.
- the observed pattern points to a higher-level mechanism in which
- information acts as an organizing principle.
- By restoring the melanin-copper balance, not only is the antioxidant defense strengthened, but also the system's ability to maintain electrical stability and energetic coherence.

Thus, project P50 1.3.3 provides further empirical evidence that energy-informational systems like Cell can initiate non-local regulations in the human organism that are both measurable and biologically verifiable.

Discussion section

The discussion section, as the concluding chapter, combines scientific reflection, energetic-informational insights, and philosophical breadth.
The results of the detailed project P50 1.3.3, by not only collecting data but also evoking awareness, point to a new dimension of biological regulation in which information acts as an ordering and connecting principle between the physical and non-physical levels.

The observed changes in the experimental group, ranging from the harmonization of melanin-related processes and copper regulation to neurovascular stability, demonstrate that this technology, via the entanglement level, is capable of restoring systemic coherence without requiring direct material intervention.

This finding expands our understanding of biological efficacy.

While classical models are based on biochemical reactions and linear signaling pathways, the present results indicate that the organism also responds to non-local informational impulses that stimulate internal self-organization.

BESA analyses capture these processes as energetic re-centering, while dark-field microscopy reveals the morphological implementation of this regulation.

The simultaneous occurrence of both phenomena suggests a higher-level mechanism of field-to-cell communication.

The central role of the test object, also with regard to melanin and subsequently copper, can be explained both biochemically and in terms of energy information:

Melanin acts as a multifunctional resonance carrier that can absorb, store, and transmit light, electrons, and possibly also quantum information.

Copper, in turn, stabilizes enzymatic activity, supports electron transfer processes, and protects against degenerative stress via antioxidant systems.

Their interaction forms a delicate balance that can easily be disrupted by environmental, electromagnetic, or psychological stress.

The results of the study indicate that this technology can recalibrate this delicate balance by introducing coherent information patterns into the system that stimulate its internal capacity for order.

Furthermore, the harmonization of the HPA axis suggests that not only peripheral but also central neuroendocrine regulatory circuits can respond to quantum informational impulses.

This opens up perspectives for future research that will investigate the connection between stress regulation, field resonance, and consciousness in greater depth.

The pilot study demonstrates that double-blind, randomized designs are also practical in research with energy-informational and quantum-technological applications when combined with suitable energetic measurement and observation methods.

Similar results have already been observed in previous studies over longer observation periods. Therefore, the current findings should be further validated with larger cohorts and longer observation periods to examine the sustainability and reproducibility of the observed effects.

From a philosophical perspective, this project can be interpreted as a further step towards an integral understanding of science, research that does not separate matter and consciousness, but rather understands both as complementary expressions of a shared, informative field.

In this sense, this project, at the level of applied research, precisely embodies what inspires it at the level of consciousness:
"the unfolding of a new reality in which humanity, technology, and the field can resonate.".

Comparative-Studies

Studies and scientific articles that address aspects related to this project — including melanin, its electrical properties, its interaction with electromagnetic radiation, and its relationship to metal ions — show a growing body of interdisciplinary exploration.
Some of these aspects are well established, while others remain in preliminary or speculative stages, particularly in the frontier area between quantum physics and non-locality.
The following section lists selected research approaches and references that may serve as valuable points of orientation for further investigation:

Title / Source	**Core Findings**	**Relevance to Project P50 1.3.3**
Melanin-based electronics: From proton conductors to … (ScienceDirect)	Review on melanin in electronic systems – proton and electron conduction, structure–function relationships.	Provides insights into melanin as a semiconducting and field-responsive material relevant for energetic interaction studies.
Enlisting electrochemistry to reveal melanin's redox-related properties (RSC)	Electrochemical analysis shows melanin is redox-active and interacts dynamically with electron donors and acceptors.	Supports the hypothesis that melanin actively participates in field interactions rather than acting as a passive pigment.
Interaction of Melanin with Metal Ions Modulates Their Cytotoxicity (Springer)	Melanin binds and modulates metal ions; can release them under specific conditions, influencing redox balance.	Directly supports the copper–melanin relationship and its regulatory implications for oxidative stress.
Engineering proton conductivity in melanin using metal doping (RSC)	Metal ion doping (Cu^{2+}, Zn^{2+}) enhances melanin's proton conductivity and modifies its electrical properties.	Relevant to understanding how copper could influence melanin's field modulation and regulatory effects.
Role of semiconductivity and ion transport in melanin (PNAS)	Investigates melanin's conductivity under humidity variation; combines EPR and transport measurements.	Important for modeling how environmental factors affect melanin's semiconductive behavior.
Melanin thin-films: optical and electrical properties (RSC)	Study on synthetic melanin thin films; details optical and conductive characteristics of modified melanin structures.	Useful as a model for understanding energy transfer and field absorption mechanisms.
Natural melanin pigments and their interfaces with metal ions and oxides (Cambridge Univ. Press)	Overview of eumelanin structure, binding to metal ions and interfaces with metal oxides.	Gives chemical foundation for the copper–melanin interaction and boundary phenomena relevant to bioenergy systems.

Application of transition metal ions in photoinduced modifications of melanin (Frontiers Partnerships)	Explores photoinduced melanin changes in the presence of transition metal ions via EPR analysis.	Highly relevant for understanding EM and light-based modulation within entangled field interactions.
The doping effect of Fe, Cu, and Zn ions on melanin conductivity (ScienceDirect)	Examines structural and conductivity changes in melanin after doping with metal ions.	Supports the idea that metal ions act as modulators of bioelectronic and regulatory functions.
Electrochemical signatures of heavy metals on synthetic melanin nanoparticle-coated electrodes (MDPI)	Melanin nanoparticles as sensors for metal ions, indicating high sensitivity to oxidative and conductive changes.	Parallel to the BESA-measured field response of biological systems exposed to metal and field stressors.

Einige relevante Studien & Forschungsergebnisse

Thema	**Studie / Artikel**	**Kurzinhalt / Relevanz**	**Hinweis / Link**
Elektrische Eigenschaften von Melanin	*Role of semiconductivity and ion transport in the electrical behavior of melanin*	Melanin zeigt elektrisch-leitende Eigenschaften, Photoleitfähigkeit, Ionentransport, interessante Parallelen zum Projekt P50 1.3.3 (PMC)	PMC
Einfluss von Kupfer auf Melanin	*The effect of copper on eumelanin photophysics and morphology*	Untersucht, wie Kupfer die Form, Photophysik und Aggregation von Eumelanin beeinflusst. (ResearchGate)	ResearchGate
Metallionen und Melaninstabilität	*Interaction of Melanin with Metal Ions Modulates Their Degradation*	Zeigt, dass Metallionen wie Kupfer und Eisen die Degradation von Melanin beschleunigen können, relevant im Sinne von Dysregulation durch „falsche“ Metallbelastungen. (SpringerLink)	SpringerLink
Strahlung & Melanin	*Ionizing Radiation Changes the Electronic Properties of Melanin*	Zeigt, dass ionisierende Strahlung die elektronischen Eigenschaften von Melanin verändern kann. (PLOS)	PLOS
Elektromagnetische Felder & Melaninproduktion	*Exposure to Radiofrequency Electromagnetic Fields Enhances Melanin Synthesis*	In Zellkulturen führte RF-EMF-Belastung zu erhöhtem Melanin-Expressionsniveau. (PMC)	PMC
Materialwissenschaftliche Anwendungen	*Heat treatment turns melanin into an electrical conductor*	Durch thermische Behandlung lässt sich die Leitfähigkeit von Eumelanin stark erhöhen, interessant, wenn man denkt, wie Melanin unter Einfluss „extern“ veränderbar ist. (physicsworld.com)	
Optische / elektrische Eigenschaften	*Electrical and optical properties of natural and synthetic melanin*	Vergleichende Messungen von Leitfähigkeit und optischen Parametern bei synthetischem und natürlichem Melanin. (ScienceDirect)	

Evaluation & Limitations

- Many of the existing studies are **materials-science or physico-chemical in orientation**, rather than biological or clinical within the human organism.
- The **transferability** of findings from **cell cultures or synthetic pigments** to **complex living systems**—which involve regulation, electrophysiology, and quantum entanglement—is **not trivial**.

- The field in which **quantum entanglement or non-local connections** are applied in a **biologically effective way** remains **highly controversial** within mainstream science and is rarely published in established journals.
- Nevertheless, these studies serve as **valuable structural "bridge pillars"**, as they demonstrate that **melanin is more than a pigment**: it possesses **electrical, optical, and metal-ion-dependent properties**, which can be **experimentally modulated and measured**.

Recommended Approach & Contacts

- Useful sources of information include databases such as **PubMed**, **Google Scholar**, and **Scopus**, using search terms like *melanin conductivity*, *melanin and copper*, *electromagnetic effects on melanocytes*, and *bioelectronic melanin*.
- **Recent review articles** often summarize multiple individual studies and highlight **research gaps** worth exploring.
- Several of the articles already mentioned include **authors and research groups** who are directly contactable — for instance, scientists working in the field of **melanin bioelectronics**.
- **Interdisciplinary conferences** in **biophysics**, **bioelectronics**, or **biophotonics** provide valuable opportunities to establish connections with researchers open to **frontier scientific fields**.

Below is a **curated mini-dossier** featuring **ten key publications** on *melanin's electrical and electromagnetic properties and its interaction with metal ions (particularly copper)*, including **brief contextual notes and a suggested contact point** for each.

1. **Dadachova et al., 2007 — PLOS ONE**
   Ionizing Radiation Changes the Electronic Properties of Melanin…
   Zeigt, dass ionisierende (und auch nicht-ionisierende) Strahlung die elektronischen Eigenschaften von Melanin verändert; melanisierte Pilzzellen wuchsen unter Strahlung schneller.
   Kontakt: Corresponding Author auf der Artikelseite: **Ekaterina Dadachova** (E-Mail ist dort angegeben). (PLOS)

2. **Mostert et al., 2012 — (Open-access auf PMC)**
   Role of semiconductivity and ion transport in the electrical behavior of melanin
   Grundlagenarbeit: Leitfähigkeit von Melanin hängt stark von Feuchte/Ionen ab; erklärt „leitfähig wenn nass".
   Kontakt: Arbeitsgruppe um **A. B. Mostert / P. Meredith** (Materialphysik/Bioelektronik). (PMC)

3. **Migliaccio et al., 2019 — Frontiers in Chemistry**
   Evidence of Unprecedented High Electronic Conductivity in Eumelanin
   Thermisches Tempern erhöht Eumelanin-Leitfähigkeit drastisch (bis ~318 S/cm) – wichtig für das Verständnis elektronischer Transportpfade.
   Kontakt: Korrespondenzadresse auf der Frontiers-Seite (Autoren in Italien; Materialwissenschaft). (Frontiers)

4. **Ligonzo et al., 2009 — Journal of Non-Crystalline Solids**
   Electrical and optical properties of natural and synthetic melanin
   Vergleich natürlicher/synthetischer Melanine: optische, elektrische und photoelektrische Messungen.
   Kontakt: Institut/Autor:innen über Verlagsseite (Sciencedirect/ADS-Abstract). (ScienceDirect)

5. **Kim et al., 2024 — (PubMed/PMC)**
   Exposure to RF-EMFs Enhances Melanin Synthesis via p53 in Mel-Ab Melanocytes
   RF-EMF (1760 MHz, SAR 4 W/kg) steigerte Melaninbildung in Melanozyten; p53-Signalweg aktiviert.
   Kontakt: Corresponding Author auf PubMed/Artikel-PDF (Dermatologie/Biophysik in KR). (PubMed)

6. **Birch & Sutter, 2013 — SPIE Proc.**
   The effect of copper on eumelanin photophysics and morphology
   Kupfer verändert Selbstorganisation/Aggregation und Photophysik von Eumelanin.
   Kontakt: D. J. S. Birch, Photophysics Group, Univ. of Strathclyde (Korrespondenz im SPIE-PDF).
   (spiedigitallibrary.org)

7. **Zadlo et al., 2017 — Cellular and Molecular Biology (Springer)**
   Redox Active Transition Metal Ions Make Melanin Susceptible to Chemical Degradation
   Cu/Fe beschleunigen die oxidativ induzierte Degradation von Melanin; mechanistische Basis für Metall-Stress.
   Kontakt: T. Sarna / A. Zadlo (Biophysik, Krakau) über Springer-Seite. (SpringerLink)

8. **Sarna et al., 2022 — Journal of Solution Chemistry**
   Interaction of Melanin with Metal Ions Modulates Their Degradation
   EPR/UV-Vis/AFM-Daten: Metallionenbindung (u. a. Cu, Fe) moduliert Melanin-Stabilität und Degradation.
   Kontakt: Korrespondierende Autor:innen über Springer-Seite. (SpringerLink)

9. **Mostert et al., 2021 — (Review, open-access)**
   Melanin, the What, the Why and the How
   Übersicht zu Redox-Eigenschaften, Elektronentransfer und funktionellen Aspekten von Melanin.
   Kontakt: Autor:innen/Institutionen über PMC/Artikel-PDF. (PMC)

10. **PhysicsWorld (News, 2019) + Primärstudie (Frontiers, s. #3)**
    Heat treatment turns melanin into an electrical conductor
    Popularwissenschaftliche Aufbereitung der Leitfähigkeits-Steigerung durch Tempern; gut für Einstieg & Pressekontakte.
    Kontakt: Für Forschung direkt #3 (Frontiers) kontaktieren; Artikel verlinkt Forschungsgruppe.
    (physicsworld.com)

Übersichtliche Einordnung für die Hypothese (Melanin-Kupfer-EM-Stabilität)

- #6, #7, #8 untermauern den **Kupfer-Hebel** (Photophysik, Aggregation, Degradationsneigung).
- #1, #3, #4, #5, #9 zeigen **elektronische/EM-Wechselwirkungen** von Melanin.
- Zusammen ist das ein tragfähiger Literatur-Korridor für deine Verbindung **Kupfermangel => Melanin-Dysregulation => elektromagnetische/elektrische Instabilität**.

Studien & Reviews – zur Studie bzw. zum Abstract

1) EEG & HRV unter RF-EMF/5G

- **EEG/HRV unter 5G-Smartphone-Exposition (mit/ohne Intervention)** – Einzelstudie mit N=10, 30-min Exposition iPhone 15 Pro; berichtet Beta/Gamma-Anstieg und HRV-Reduktion, sowie Abschwächung unter „Quantum Upgrade“ (explorativ, kleine Stichprobe). (ifqtf.org)
  https://ifqtf.org/wp-content/uploads/2025/04/DSGIP_EEG_HRV_IPhone15pro_Quantum_Upgrade_2025-04-22_eng-1.pdf?utm_source=chatgpt.com
- **Systematisches Review zu RF-EMF und Herzaktivität/HRV (BEMS/Wiley)** – bündelt Humanstudien zu HR/HRV unter RF-EMF. (Wiley Online Library)
  https://onlinelibrary.wiley.com/doi/pdf/10.1002/bem.70014?utm_source=chatgpt.com
- **Randomisierte Crossover-Studie: Mobilfunk-RF und Ruhe-EEG** – methodisch sauberer Ansatz (doppelblind, Gegenbalancierung). (doris.bfs.de)
  https://doris.bfs.de/jspui/bitstream/urn%3Anbn%3Ade%3A0221-2024121749259/1/SL_VanderMeer_2023_EffectsOfMobile_Eng.pdf?utm_source=chatgpt.com

Nutzen: Belegt die Wahl von **EEG-Bändern (Theta/Alpha/Beta/Gamma)** und **HRV-Parametern (SDNN, RMSSD, HF/LF, LF/HF)** als sensible Endpunkte.

2) Oxidativer Stress (Rahmen für 5-HMF)

- **WHO-beauftragte systematische Reviews zu oxidativem Stress unter RF-EMF** – umfassende Auswertung (Tier/Cell, teils auch Human-Daten in der Reihe), methodisch streng. (ScienceDirect)
  https://www.sciencedirect.com/science/article/pii/S0160412024005269?utm_source=chatgpt.com

Einordnung 5-HMF: 5-HMF ist ein **plausibler oxidativer Marker**, aber direkte Human-Daten *speziell zu RF-EMF* sind rar und kann daher als **explorativen Biomarker** mit Bezug auf die WHO-Reviews zu „oxidative stress markers“ begründet werden.

3) α-Ketoglutarsäure (AKG) – energetischer & antioxidativer Marker

- **Humannahe Evidenz (Kardiologie):** Korrelationen von AKG mit oxidativem Stress/Prognose (zeigt Relevanz als metabolischer Marker). (Frontiers)
  https://www.frontiersin.org/journals/cardiovascular-medicine/articles/10.3389/fcvm.2025.1544537/full?utm_source=chatgpt.com
- **Experimentell (Neuro/Altern-Modelle):** AKG dämpft oxidativen Stress, verbessert mitochondriale Funktionen (Mechanistik). (MDPI)
  https://www.mdpi.com/1424-8247/18/8/1080?utm_source=chatgpt.com

Nutzen: Rechtfertigt **AKG** als **zellulären Energiestatus-/Mitochondrien-Proxy** im EMF-Kontext (als *a priori* Hypothese; Kausalität zu EMF noch zu zeigen).

4) Melatonin & zirkadiane Achse (inkl. HPA-Bezug)

- **Review: EMF, Melatonin, Schlaf/EEG** – Überblick zu Effekten auf Melatoninsekretion und Schlafarchitektur. (ScienceDirect)
  https://www.sciencedirect.com/science/article/abs/pii/S1087079219300073?utm_source=chatgpt.com
- **Aktueller Übersichtsartikel (MDPI/Biomolecules):** Melatonin, elektromagnetische Felder und physiologische Effekte. (MDPI)
  https://www.mdpi.com/2218-273X/14/8/929?utm_source=chatgpt.com
- **HPA-Achse – Grundlagentext** (Rhythmik/Cortisol; für Protokoll-Begründung der Messzeitpunkte). (ScienceDirect)
  https://www.sciencedirect.com/science/article/abs/pii/S1521690X17301094?utm_source=chatgpt.com

Nutzen: Stützt die Auswahl **Melatonin** (und **Cortisol/HPA**) als **zeitpunkt-sensitive** Marker → zur konsistenten Messung (z. B. spätnachmittags/abends), um zirkadiane Konfounder zu minimieren.

5) Melanin & EMF / Strahlungs-Interaktion

- **Review zu Melanin–Strahlungs-Interaktionen** (fundamental bis angewandt): Absorption, Redox, Materialeigenschaften. (scholars.northwestern.edu)
- **RF-EMF fördert Melanogenese in Melanozyten (1760 MHz)** – Zunahme der Melaninproduktion in Zellmodellen (in vitro). (MDPI)
  https://www.mdpi.com/1422-0067/25/22/12457?utm_source=chatgpt.com
- **Metall-modifiziertes Melanin – optische/Redox-Eigenschaften** (zeigt Bindungs-/Schutzpotenziale). (ScienceDirect)
  https://www.sciencedirect.com/science/article/pii/S2405844024053180?utm_source=chatgpt.com

Nutzen: Begründet **Melanin** als **frequenz-/lichtsensitiven Biomarker** mit möglicher Schutz-/Resonanzrolle; direkte Human-EMF-Daten sind limitiert → als **Hypothesen-Achse** deklarieren.

6) 5G/mmWave – allgemeiner Rahmen

- **Sensors-Übersicht 2025:** Wirkung höherfrequenter mmWaves (5G), geringe Eindringtiefe, mögliche indirekte Effekte. (MDPI)
  https://www.mdpi.com/1424-8220/25/9/2749?utm_source=chatgpt.com
- **WHO-Programm „RF-EMF systematische Reviews" – Protokolle (u. a. Tinnitus/Migräne)** → zeigt die aktuelle Evidenzaufbereitung. (doris.bfs.de)
  https://doris.bfs.de/jspui/bitstream/urn%3Anbn%3Ade%3A0221-2024042443254/4/SL_WHO-Systematic-Reviews_2024_Deu.pdf?utm_source=chatgpt.com

Nutzen: Kontextualisiert unser 5G-Setting; zeigt Forschungsstand & offene Fragen.

- **Primäre Endpunkte:** EEG-Leistungsdichten (Θ/α/β/γ) + HRV (SDNN, RMSSD, HF/LF, LF/HF). (Begründung: s. oben.) (Wiley Online Library)
  https://onlinelibrary.wiley.com/doi/pdf/10.1002/bem.70014?utm_source=chatgpt.com
- **Sekundäre/Explorative Biomarker:** Melatonin (Speichel/Plasma; abends), Cortisol (HPA), **AKG**, **5-HMF**, **Kupfer** (Serum; optional Ceruloplasmin). (Begründung: oxidativer Stress, Mitochondrien, zirkadiane Achse.) (ScienceDirect)
  https://www.sciencedirect.com/science/article/pii/S0160412024005269?utm_source=chatgpt.com

- **Timing:** Zirkadiane Standardisierung (konstante Uhrzeit, Fastenstatus/Letztmahlzeit dokumentieren). (Begründung: HPA/Melatonin-Rhythmen.) (ScienceDirect) https://www.sciencedirect.com/science/article/abs/pii/S1521690X17301094?utm_source=chatgpt.com
- **Design:** Randomisiert, doppelblind, Crossover (Ohne-EMF / EMF / EMF+Intervention), 20–40 min Exposition, Wash-out, Artefakt-Kontrolle (EOG/EMG). (Methoden-Referenz: EEG-/HRV-Studien oben.) (doris.bfs.de) https://doris.bfs.de/jspui/bitstream/urn%3Anbn%3Ade%3A0221-2024121749259/1/SL_VanderMeer_2023_EffectsOfMobile_Eng.pdf?utm_source=chatgpt.com

Rationale & Endpunkte

Im Rahmen dieser Studie werden elektromagnetische Felder (EMF), insbesondere von 5G-Smartphones (6G), als potenzielle Stressoren des biologischen Systems betrachtet. Diverse Human- und Meta-Analysen zeigen eine signifikante Verringerung von Herzratenvariabilitäts-Parametern (z. B. SDNN, SDANN, pNN50) unter EMF-Belastung. (De Gruyter Brill)
Studien zur Interaktion von EMF mit Melatonin-Sekretion und Schlafrhythmik deuten auf einen Einfluss elektromagnetischer Felder auf die zirkadiane Regulation und antioxidative Prozesse hin. (ScienceDirect)
Somit erscheinen HRV (als Indikator autonomen Nervensystems und Stressregulation), Melatonin (zirkadiane & antioxidative Regulation) sowie weitere biochemische Marker wie Kupfer, 5-Hydroxymethylfurfural (5-HMF) und α-Ketoglutarsäure (AKG) als geeignete Endpunkte für die Bewertung der bioenergieinformativen Wirkung einer quantenbasierte Technologie zur Neutralisation von EMSF-Effekten.

Hauptendpunkte:

- HRV-Zeitbereichs- und Spektralparameter (SDNN, RMSSD, HF, LF, LF/HF)
- EEG-Leistungsdichten in Theta, Alpha, Beta und Gamma-Bändern (zentrale, temporale, parietale und okzipitale Areale)
- Melatonin- (Plasma/Speichel) und Cortisol-(HPA-Achse)-Werte

Explorative Marker:

- Kupfer (Serum) – als Spurenelement der antioxidativen und neuronalen Regulation
- 5-HMF – als Oxidativitäts-/Nitrosativitätsindikator
- AKG – als zellulärer Energiestatusindikator

Vergleichs-Studien

Studien und wissenschaftliche Artikel, die sich mit Aspekten befassen, die diesem Projekt nahekommen (Melanin, elektrische Eigenschaften, Wechselwirkung mit elektromagnetischer Strahlung, Metallionen). Manche Aspekte sind etabliert, andere noch in Vorstufe oder Spekulation, gerade im Grenzgebiet von Quanten- bzw. Nicht-Lokalität.

Hier sind ein paar interessante Forschungsansätze + Hinweise zur Weiterverfolgung:

Einige relevante Studien & Forschungsergebnisse

Thema	Studie / Artikel	Kurzinhalt / Relevanz	Hinweis / Link
Elektrische Eigenschaften von Melanin	*Role of semiconductivity and ion transport in the electrical behavior of*	Melanin zeigt elektrisch-leitende Eigenschaften, Photoleitfähigkeit, Ionentransport, interessante Parallelen zum	PMC

Thema	Studie / Artikel	Kurzinhalt / Relevanz	Hinweis / Link
	melanin	Projekt P83 (PMC)	
Einfluss von Kupfer auf Melanin	*The effect of copper on eumelanin photophysics and morphology*	Untersucht, wie Kupfer die Form, Photophysik und Aggregation von Eumelanin beeinflusst. (ResearchGate)	ResearchGate
Metallionen und Melaninstabilität	*Interaction of Melanin with Metal Ions Modulates Their Degradation*	Zeigt, dass Metallionen wie Kupfer und Eisen die Degradation von Melanin beschleunigen können, relevant im Sinne von Dysregulation durch „falsche" Metallbelastungen. (SpringerLink)	SpringerLink
Strahlung & Melanin	*Ionizing Radiation Changes the Electronic Properties of Melanin*	Zeigt, dass ionisierende Strahlung die elektronischen Eigenschaften von Melanin verändern kann. (PLOS)	PLOS
Elektromagnetische Felder & Melaninproduktion	*Exposure to Radiofrequency Electromagnetic Fields Enhances Melanin Synthesis*	In Zellkulturen führte RF-EMF-Belastung zu erhöhtem Melanin-Expressionsniveau. (PMC)	PMC
Materialwissenschaftliche Anwendungen	*Heat treatment turns melanin into an electrical conductor*	Durch thermische Behandlung lässt sich die Leitfähigkeit von Eumelanin stark erhöhen, interessant, wenn man denkt, wie Melanin unter Einfluss „extern" veränderbar ist. (physicsworld.com)	
Optische / elektrische Eigenschaften	*Electrical and optical properties of natural and synthetic melanin*	Vergleichende Messungen von Leitfähigkeit und optischen Parametern bei synthetischem und natürlichem Melanin. (ScienceDirect)	

Bewertung & Grenzen

- Viele dieser Studien sind *Materialwissenschaftlich* oder *chemisch-physikalisch* orientiert, nicht biologisch-klinisch im menschlichen Organismus.
- Die Übertragung von Zellkultur / synthetischem Pigment auf komplexe lebende Systeme mit Regulation, Elektrophysiologie und Quantenverschränkung ist nicht trivial.
- Der Bereich, in dem **Quantenverschränkung** oder **nicht-lokale Verbindung** biologisch wirksam eingesetzt wird, ist in der etablierten Wissenschaft noch sehr kontrovers und kaum Mainstream publiziert.
- Dennoch sind die existierenden Studien wertvolle „Brückenpfeiler", denn sie zeigen, dass Melanin mehr ist als ein Pigment: mit elektrischen, optischen und metallionenabhängigen Eigenschaften, die in Experimenten veränderbar sind.

Empfohlene Vorgehensweise & Kontakte

- Auskunft zum Thema geben Datenbanken wie **PubMed**, **Google Scholar**, **Scopus** mit Suchbegriffen wie *melanin conductivity*, *melanin and copper*, *electromagnetic effects on melanocytes*, *bioelectronic melanin*.
- Neuere Übersichtsarbeiten (Reviews) fassen oft viele Einzelstudien zusammen und zeigen Forschungslücken.
- Einige der bereits genannten Artikel haben Autoren und Gruppen, die direkt kontaktierbar sind (z. B. Forscher, die an Melanin-Bioelektronik arbeiten).

- In interdisziplinären Konferenzen (Biophysik, Bioelektronik, Biophotonik) lassen sich auch Kontakte knüpfen, die offen für Grenzbereiche sind.

Hier ein kuratiertes Klein-Dossier (10 Publikationen) rund um **Melanin-elektrische/EM-Eigenschaften-Metallionen (Kupfer)**, inkl. kurzer Einordnung und einem konkreten Kontakt-Hinweis pro Eintrag.

11. **Dadachova et al., 2007 — PLOS ONE**
    Ionizing Radiation Changes the Electronic Properties of Melanin…
    Zeigt, dass ionisierende (und auch nicht-ionisierende) Strahlung die elektronischen Eigenschaften von Melanin verändert; melanisierte Pilzzellen wuchsen unter Strahlung schneller.
    Kontakt: Corresponding Author auf der Artikelseite: **Ekaterina Dadachova** (E-Mail ist dort angegeben). (PLOS)

12. **Mostert et al., 2012 — (Open-access auf PMC)**
    Role of semiconductivity and ion transport in the electrical behavior of melanin
    Grundlagenarbeit: Leitfähigkeit von Melanin hängt stark von Feuchte/Ionen ab; erklärt „leitfähig wenn nass".
    Kontakt: Arbeitsgruppe um **A. B. Mostert / P. Meredith** (Materialphysik/Bioelektronik). (PMC)

13. **Migliaccio et al., 2019 — Frontiers in Chemistry**
    Evidence of Unprecedented High Electronic Conductivity in Eumelanin
    Thermisches Tempern erhöht Eumelanin-Leitfähigkeit drastisch (bis ~318 S/cm) – wichtig für das Verständnis elektronischer Transportpfade.
    Kontakt: Korrespondenzadresse auf der Frontiers-Seite (Autoren in Italien; Materialwissenschaft). (Frontiers)

14. **Ligonzo et al., 2009 — Journal of Non-Crystalline Solids**
    Electrical and optical properties of natural and synthetic melanin
    Vergleich natürlicher/synthetischer Melanine: optische, elektrische und photoelektrische Messungen.
    Kontakt: Institut/Autor:innen über Verlagsseite (Sciencedirect/ADS-Abstract). (ScienceDirect)

15. **Kim et al., 2024 — (PubMed/PMC)**
    Exposure to RF-EMFs Enhances Melanin Synthesis via p53 in Mel-Ab Melanocytes
    RF-EMF (1760 MHz, SAR 4 W/kg) steigerte Melaninbildung in Melanozyten; p53-Signalweg aktiviert.
    Kontakt: Corresponding Author auf PubMed/Artikel-PDF (Dermatologie/Biophysik in KR). (PubMed)

16. **Birch & Sutter, 2013 — SPIE Proc.**
    The effect of copper on eumelanin photophysics and morphology
    Kupfer verändert Selbstorganisation/Aggregation und Photophysik von Eumelanin.
    Kontakt: D. J. S. Birch, Photophysics Group, Univ. of Strathclyde (Korrespondenz im SPIE-PDF). (spiedigitallibrary.org)

17. **Zadlo et al., 2017 — Cellular and Molecular Biology (Springer)**
    Redox Active Transition Metal Ions Make Melanin Susceptible to Chemical Degradation
    Cu/Fe beschleunigen die oxidativ induzierte Degradation von Melanin; mechanistische Basis für Metall-Stress.
    Kontakt: T. Sarna / A. Zadlo (Biophysik, Krakau) über Springer-Seite. (SpringerLink)

18. **Sarna et al., 2022 — Journal of Solution Chemistry**
    Interaction of Melanin with Metal Ions Modulates Their Degradation
    EPR/UV-Vis/AFM-Daten: Metallionenbindung (u. a. Cu, Fe) moduliert Melanin-Stabilität und

Degradation.
Kontakt: Korrespondierende Autor:innen über Springer-Seite. (SpringerLink)

19. **Mostert et al., 2021 — (Review, open-access)**
Melanin, the What, the Why and the How
Übersicht zu Redox-Eigenschaften, Elektronentransfer und funktionellen Aspekten von Melanin.
Kontakt: Autor:innen/Institutionen über PMC/Artikel-PDF. (PMC)

20. **PhysicsWorld (News, 2019) + Primärstudie (Frontiers, s. #3)**
Heat treatment turns melanin into an electrical conductor
Popularwissenschaftliche Aufbereitung der Leitfähigkeits-Steigerung durch Tempern; gut für Einstieg & Pressekontakte.
Kontakt: Für Forschung direkt #3 (Frontiers) kontaktieren; Artikel verlinkt Forschungsgruppe. (physicsworld.com)

Übersichtliche Einordnung für die Hypothese (Melanin-Kupfer-EM-Stabilität)

- #6, #7, #8 untermauern den **Kupfer-Hebel** (Photophysik, Aggregation, Degradationsneigung).
- #1, #3, #4, #5, #9 zeigen **elektronische/EM-Wechselwirkungen** von Melanin.
- Zusammen ist das ein tragfähiger Literatur-Korridor für deine Verbindung **Kupfermangel => Melanin-Dysregulation => elektromagnetische/elektrische Instabilität**.

Studien & Reviews – zur Studie bzw. zum Abstract

1) EEG & HRV unter RF-EMF/5G

- **EEG/HRV unter 5G-Smartphone-Exposition (mit/ohne Intervention)** – Einzelstudie mit N=10, 30-min Exposition iPhone 15 Pro; berichtet Beta/Gamma-Anstieg und HRV-Reduktion, sowie Abschwächung unter „Quantum Upgrade“ (explorativ, kleine Stichprobe). (ifqtf.org)
https://ifqtf.org/wp-content/uploads/2025/04/DSGIP_EEG_HRV_IPhone15pro_Quantum_Upgrade_2025-04-22_eng-1.pdf?utm_source=chatgpt.com

- **Systematisches Review zu RF-EMF und Herzaktivität/HRV (BEMS/Wiley)** – bündelt Humanstudien zu HR/HRV unter RF-EMF. (Wiley Online Library)
https://onlinelibrary.wiley.com/doi/pdf/10.1002/bem.70014?utm_source=chatgpt.com

- **Randomisierte Crossover-Studie: Mobilfunk-RF und Ruhe-EEG** – methodisch sauberer Ansatz (doppelblind, Gegenbalancierung). (doris.bfs.de)
https://doris.bfs.de/jspui/bitstream/urn%3Anbn%3Ade%3A0221-2024121749259/1/SL_VanderMeer_2023_EffectsOfMobile_Eng.pdf?utm_source=chatgpt.com

Nutzen: Belegt die Wahl von **EEG-Bändern (Theta/Alpha/Beta/Gamma)** und **HRV-Parametern (SDNN, RMSSD, HF/LF, LF/HF)** als sensible Endpunkte.

2) Oxidativer Stress (Rahmen für 5-HMF)

- **WHO-beauftragte systematische Reviews zu oxidativem Stress unter RF-EMF** – umfassende Auswertung (Tier/Cell, teils auch Human-Daten in der Reihe), methodisch streng. (ScienceDirect)
https://www.sciencedirect.com/science/article/pii/S0160412024005269?utm_source=chatgpt.com

Einordnung 5-HMF: 5-HMF ist ein **plausibler oxidativer Marker**, aber direkte Human-Daten *speziell zu RF-EMF* sind rar und kann daher als **explorativen Biomarker** mit Bezug auf die WHO-Reviews zu „oxidative stress markers" begründet werden.

3) α-Ketoglutarsäure (AKG) – energetischer & antioxidativer Marker

- **Humannahe Evidenz (Kardiologie):** Korrelationen von AKG mit oxidativem Stress/Prognose (zeigt Relevanz als metabolischer Marker). (Frontiers)
  https://www.frontiersin.org/journals/cardiovascular-medicine/articles/10.3389/fcvm.2025.1544537/full?utm_source=chatgpt.com
- **Experimentell (Neuro/Altern-Modelle):** AKG dämpft oxidativen Stress, verbessert mitochondriale Funktionen (Mechanistik). (MDPI)
  https://www.mdpi.com/1424-8247/18/8/1080?utm_source=chatgpt.com

Nutzen: Rechtfertigt **AKG** als **zellulären Energiestatus-/Mitochondrien-Proxy** im EMF-Kontext (als *a priori* Hypothese; Kausalität zu EMF noch zu zeigen).

4) Melatonin & zirkadiane Achse (inkl. HPA-Bezug)

- **Review: EMF, Melatonin, Schlaf/EEG** – Überblick zu Effekten auf Melatoninsekretion und Schlafarchitektur. (ScienceDirect)
  https://www.sciencedirect.com/science/article/abs/pii/S1087079219300073?utm_source=chatgpt.com
- **Aktueller Übersichtsartikel (MDPI/Biomolecules):** Melatonin, elektromagnetische Felder und physiologische Effekte. (MDPI)
  https://www.mdpi.com/2218-273X/14/8/929?utm_source=chatgpt.com
- **HPA-Achse – Grundlagentext** (Rhythmik/Cortisol; für Protokoll-Begründung der Messzeitpunkte). (ScienceDirect)
  https://www.sciencedirect.com/science/article/abs/pii/S1521690X17301094?utm_source=chatgpt.com

Nutzen: Stützt die Auswahl **Melatonin** (und **Cortisol/HPA**) als **zeitpunkt-sensitive** Marker → zur konsistenten Messung (z. B. spätnachmittags/abends), um zirkadiane Konfounder zu minimieren.

5) Melanin & EMF / Strahlungs-Interaktion

- **Review zu Melanin–Strahlungs-Interaktionen** (fundamental bis angewandt): Absorption, Redox, Materialeigenschaften. (scholars.northwestern.edu)
- **RF-EMF fördert Melanogenese in Melanozyten (1760 MHz)** – Zunahme der Melaninproduktion in Zellmodellen (in vitro). (MDPI)
  https://www.mdpi.com/1422-0067/25/22/12457?utm_source=chatgpt.com
- **Metall-modifiziertes Melanin – optische/Redox-Eigenschaften** (zeigt Bindungs-/Schutzpotenziale). (ScienceDirect)
  https://www.sciencedirect.com/science/article/pii/S2405844024053180?utm_source=chatgpt.com

Nutzen: Begründet **Melanin** als **frequenz-/lichtsensitiven Biomarker** mit möglicher Schutz-/Resonanzrolle; direkte Human-EMF-Daten sind limitiert → als **Hypothesen-Achse** deklarieren.

6) 5G/mmWave – allgemeiner Rahmen

- **Sensors-Übersicht 2025:** Wirkung höherfrequenter mmWaves (5G), geringe Eindringtiefe, mögliche indirekte Effekte. (MDPI)
  https://www.mdpi.com/1424-8220/25/9/2749?utm_source=chatgpt.com
- **WHO-Programm „RF-EMF systematische Reviews" – Protokolle (u. a. Tinnitus/Migräne)** → zeigt die aktuelle Evidenzaufbereitung. (doris.bfs.de)
  https://doris.bfs.de/jspui/bitstream/urn%3Anbn%3Ade%3A0221-2024042443254/4/SL_WHO-Systematic-Reviews_2024_Deu.pdf?utm_source=chatgpt.com

Nutzen: Kontextualisiert unser 5G-Setting; zeigt Forschungsstand & offene Fragen.

Empfehlung für die Projektbeschreibung (Protokoll) kurz & praktisch

- **Primäre Endpunkte:** EEG-Leistungsdichten (Θ/α/β/γ) + HRV (SDNN, RMSSD, HF/LF, LF/HF). (Begründung: s. oben.) (Wiley Online Library)
  https://onlinelibrary.wiley.com/doi/pdf/10.1002/bem.70014?utm_source=chatgpt.com
- **Sekundäre/Explorative Biomarker:** Melatonin (Speichel/Plasma; abends), Cortisol (HPA), **AKG**, **5-HMF**, **Kupfer** (Serum; optional Ceruloplasmin). (Begründung: oxidativer Stress, Mitochondrien, zirkadiane Achse.) (ScienceDirect)
  https://www.sciencedirect.com/science/article/pii/S0160412024005269?utm_source=chatgpt.com
- **Timing:** Zirkadiane Standardisierung (konstante Uhrzeit, Fastenstatus/Letztmahlzeit dokumentieren). (Begründung: HPA/Melatonin-Rhythmen.) (ScienceDirect)
  https://www.sciencedirect.com/science/article/abs/pii/S1521690X17301094?utm_source=chatgpt.com
- **Design:** Randomisiert, doppelblind, Crossover (Ohne-EMF / EMF / EMF+Intervention), 20–40 min Exposition, Wash-out, Artefakt-Kontrolle (EOG/EMG). (Methoden-Referenz: EEG-/HRV-Studien oben.) (doris.bfs.de) https://doris.bfs.de/jspui/bitstream/urn%3Anbn%3Ade%3A0221-2024121749259/1/SL_VanderMeer_2023_EffectsOfMobile_Eng.pdf?utm_source=chatgpt.com

Rationale & Endpunkte

Im Rahmen dieser Studie werden elektromagnetische Felder (EMF), insbesondere von 5G-Smartphones (6G), als potenzielle Stressoren des biologischen Systems betrachtet. Diverse Human- und Meta-Analysen zeigen eine signifikante Verringerung von Herzratenvariabilitäts-Parametern (z. B. SDNN, SDANN, pNN50) unter EMF-Belastung. (De Gruyter Brill)
Studien zur Interaktion von EMF mit Melatonin-Sekretion und Schlafrhythmik deuten auf einen Einfluss elektromagnetischer Felder auf die zirkadiane Regulation und antioxidative Prozesse hin. (ScienceDirect)
Somit erscheinen HRV (als Indikator autonomen Nervensystems und Stressregulation), Melatonin (zirkadiane & antioxidative Regulation) sowie weitere biochemische Marker wie Kupfer, 5-Hydroxymethylfurfural (5-HMF) und α-Ketoglutarsäure (AKG) als geeignete Endpunkte für die Bewertung der bioenergieinformativen Wirkung einer quantenbasierte Technologie zur Neutralisation von EMSF-Effekten.

Hauptendpunkte:

- HRV-Zeitbereichs- und Spektralparameter (SDNN, RMSSD, HF, LF, LF/HF)

- EEG-Leistungsdichten in Theta, Alpha, Beta und Gamma-Bändern (zentrale, temporale, parietale und okzipitale Areale)
- Melatonin- (Plasma/Speichel) und Cortisol-(HPA-Achse)-Werte

Explorative Marker:

- Kupfer (Serum) – als Spurenelement der antioxidativen und neuronalen Regulation
- 5-HMF – als Oxidativitäts-/Nitrosativitätsindikator
- AKG – als zellulärer Energiestatusindikator