

Aires response to the HHS request on electromagnetic fields

Three decades of research on electromagnetic environments and biological function

Prepared by Aires | October 21 2026

U.S. Department of Health and Human Services

Request for Information on Electromagnetic Fields, Radiofrequency Radiation, and Wireless Radiation Exposure

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Executive summary

For more than three decades, the Aires research program has pursued one enduring objective: to engineer electromagnetic environments that support biological function. The documented history extends to 1992. Materials and devices have evolved from patterned graphite and optical filters to structured silicon resonators, while biological testing has remained central to evaluating their effects. [1–14]

This record brings together **more than 50 named authors and researchers**, with **15 academic, medical and research institutions** represented through testing sites or author affiliations, and contributions from **Russia, Lithuania and Canada**. It spans human brain and autonomic measurements; human erythrocytes tested outside the body; rat bone-marrow chromosomes, behavior, learning and blood parameters; honeybee behavior, memory and gene expression; and goldfish movement. Water, liquid crystals, thin films and silicon experiments add the physical and physicochemical investigations. [2–33, 36–44]

The program contributes directly to HHS's inquiry because testing an intervention also requires investigating the exposure response. Its mobile-phone and Wi-Fi experiments therefore address two connected questions: what biological changes occur under specified exposures, and what changes when an Aires intervention is introduced? Repeated rat bone-marrow investigations reported increased chromosome abnormalities under router exposure and reductions with resonators. [15–30]

The submission provides [44 reference entries and source documents](#) identifying journal articles, conference papers, technical reports and historical or methodological sources. These connect biological findings with engineering, including the 2018 Lithuanian investigation of gigahertz fields and Springer ICICT modeling and materials papers. Appendix A describes the broader archive and its scope. [14–16, 18–19, 22, 31, 33]

Today's Aires consumer technology business is an application of this research lineage. The same environmental thesis motivates further evaluation in occupied spaces and equipment integration.

We ask HHS to engage Aires in a technical briefing, examine this connected research record, and include field-modulation approaches in its research priorities. Aires can contribute a documented history of materials, exposure protocols and biological assays to help HHS design coordinated physical and biological investigations.

Research breadth and relevance to HHS

The following map makes the range of test systems explicit. Cells and blood include both human samples tested outside the body and measurements made in exposed animals. Water and materials are physical test systems that inform the program's biological questions.

Test system	Tests and source references	Relevant HHS questions
Humans	EEG brain activity, ECG and heart-rate variability, recovery, functional-state and cognitive assessments; early clinical and optical-filter investigations. [6–9, 21–29, 39–41, 44]	4, 7–8, 11–12
Human erythrocytes	Osmotic swelling and spherulation of red blood cells from ten donor samples, examined by laser diffraction after exposure to a silicon resonator. [10]	4, 7–8, 18
Rat bone-marrow cells	Chromosome-aberration frequency after Wi-Fi exposure, with reference, exposure-only and resonator conditions; Wistar and selected rat lines. [15–16]	4, 11–12
Rat behavior and memory	Locomotion, exploration, learning and memory, and responses under altered magnetic conditions. [17, 30]	4, 11–12
Rat blood	Erythrocyte and leukocyte measures, hemoglobin, hematocrit and other hematological parameters in the 2025 exposure study. [30]	4, 11–12
Honeybees	Feeding motivation, learned responses, short- and long-term memory, and brain hsp70 gene expression; later exploratory colony observations. [18–20, 42]	14, 16
Goldfish	Automated video analysis of movement under mobile-phone exposure and with an Aires neutralizer. [36]	14, 18
Water	Conductivity, infrared transmission and pH investigations in aqueous systems. [4–5]	5, 7–8, 18
Physical materials and fields	Liquid crystals, copper and nanoscale films, patterned silicon, electromagnetic modeling, direct RF measurements and thermal-infrared characterization. [2–3, 11–14, 31–33, 37–38, 43]	5, 7–8, 16

Question 12 specifically concerns exposures below federal limits; the corresponding response explains how the individual exposure records should be assessed against those limits. Numbered references identify the study generation, publication or report, and the test system actually investigated.

Question 2 Respondent perspective

Aires submits this response from the perspective of a technology manufacturer and a participant in the development and sponsorship of research on electromagnetic environments. Today's consumer technology business draws on a program whose documented organizational history extends to 1992. Earlier foundations, researchers and collaborating organizations contributed the materials, modeling and biological work that preceded successive generations of consumer products. [1]

Our submission draws on journal articles, conference publications, commissioned technical reports and experimental research reports. The references identify these source types. The program includes work on earlier graphite applicators and optical filters, subsequent silicon structures, and later Aires and Lifetune devices. Each generation contributes to the development history; results remain associated with the material, device and experimental conditions actually investigated.

Questions 4 and 18 The contribution of the complete research program

An enduring thesis across changing technologies

The organizing idea has always been environmental: biological systems interact with the physical conditions around them, and an engineered change in those conditions can be investigated through a biological response. In this submission, tuning an environment means deliberately changing measurable electromagnetic conditions with the aim of supporting biological functioning. The question is tested through physical measurements and biological endpoints.

Understanding the program requires following that idea across its successive forms. A water experiment examines a physical medium. An erythrocyte experiment examines a biological sample. An EEG experiment examines brain electrical activity. A rat chromosome study examines cellular integrity. A honeybee experiment examines behavior, memory or gene expression. These methods address different parts of the same broader inquiry. Their value lies in the questions they connect and the experimental observations they contribute.

Early materials and human investigations established the research direction

Early work explored patterned graphite applicators, optical filters, water, liquid crystals and thin films. Human reports from 2000 onward examined functional state, physiological measurements and responses to earlier patterned materials. The 2001–2002 Bekhterev investigation used optical filters and EEG to examine the relationship between structured visual input and brain activity. These studies established biology as a means of evaluating the program's physical designs. [2–9, 37–38]

Materials research investigated the relationship between patterned structures and the behavior of matter, including liquid-crystal organization and deposited thin films. Water investigations examined conductivity and infrared characteristics. These are physical and physicochemical parts of the record. Their role is to explore interaction mechanisms and experimental methods that can inform subsequent engineering. [2–5]

Human erythrocytes provided a direct cellular test

The 2005 study of **erythrocytes in human blood** brought a defined cellular system into the program. Researchers examined ten blood samples from patients with multiple myeloma. Washed red blood cells were placed in saline solutions of different concentrations, and a helium-neon laser diffraction

method tracked osmotic swelling and the transition toward spherical cell shape. The silicon resonator was positioned beneath the sample chamber. [10]

The report describes favorable changes in osmotic-response characteristics in several samples, with the direction and magnitude depending on the sample and exposure duration. This is a direct investigation of a red-blood-cell membrane-related response outside the body. Its place in the program is specific: it extends the inquiry from physical materials and whole-person physiological recordings to a measurable cellular property. Together with the early human work, it made starting condition and observation time recurring experimental variables. [7, 10]

Silicon structures made geometry an explicit engineering variable

The move into patterned silicon developed a physical structure whose geometry, charge distribution and response to incident radiation could be modeled. The 2007 mathematical work and subsequent computational studies examined electromagnetic interaction with structured semiconductor surfaces. Later designs explored different ring configurations and arrangements. [11–12, 31–32]

The 2016–2018 Vilnius Gediminas Technical University program added direct radiofrequency measurements. It examined resonator prototypes, their placement and combinations under specified source and receiver configurations. Reported changes depended on geometry and measurement position. This supplied practical information about how an intervention interacts with a field and why arrangement must be part of the experimental description. The associated paper at the 12th International Scientific Conference on Intelligent Technologies in Logistics and Mechatronics Systems in Panevezys, Lithuania, April 26–27, 2018, connected Lithuanian and Russian researchers in a shared physical investigation. The HOLOEXPO 2017 proceedings had already brought together the modeling and laboratory work on self-affine resonator structures. [13–14, 43]

This phase matters to the biological thesis because an environmental intervention needs a physical description. Material, pattern, placement, source behavior and measurement location are engineering variables that can be investigated alongside biological response.

Rat bone marrow connected exposure challenges with cellular outcomes

The mitigation experiments introduced a particularly important experimental sequence: characterize a reference condition, apply a defined exposure, measure the resulting response, and examine the response when an Aires device is added. In studies that establish an adverse exposure response, the intervention comparison then tests whether that disturbance changes.

The rat cytogenetic series provides a concrete example. It examined **chromosome abnormalities in bone-marrow cells**, including disturbances observed during cell division. The initial program compared exposure durations and measured these cellular outcomes after Wi-Fi exposure. In the four-day protocol reported in 2018, the frequency of abnormal cells was approximately 26.0% with the router, 5.7% in the matched cage control and 6.5% with the router plus resonators. [15]

The next stage repeated the inquiry in Wistar rats and extended it to lines selected for contrasting nervous-system excitability. The publication in Ecological Genetics is identifiable by DOI 10.17816/ecogen17283-92. In the Wistar comparison published in 2019, exposure increased the frequency of chromosome disturbances 3.9-fold relative to the matched cage control; adding resonators reduced that frequency 2.8-fold relative to exposure alone. Results across the selected lines further connected biological susceptibility with the magnitude of response. [16]

These are repeated observations of an exposure-associated cellular disturbance and its attenuation within a continuing experimental program. They give HHS relevant evidence at both stages of the comparison. Chromosomal disturbance has a recognized biological meaning as a genetic-toxicology endpoint; its significance can be discussed directly at the cellular level. [15–16, 34]

Biological diversity expanded the inquiry

Subsequent rat investigations examined behavior, learning and memory, magnetic background conditions and, in the 2025 work, hematological measures with a newer router and Lifetune Zone Max devices. The program thereby expanded from cellular observations to organism-level responses and different biological starting conditions. The 2025 report describes attenuation of selected exposure-associated behavioral changes and shifts in several blood parameters toward reference values, with responses differing between rat lines and endpoints. [17, 30]

Honeybee work added sensory response, feeding motivation, memory and stress-responsive gene expression. The exposure studies examined how duration and the interval between learning and testing affected the response. Later experiments examined resonators and magnetic-field conditions. These results make timing and endpoint selection central to environmental testing. [18–20]

Human EEG and HRV studies trace regulation and recovery

Human neurophysiology provides a continuing thread through more than two decades of Aires research. Within the broader 30-year development program, investigators have used electroencephalography (EEG), electrocardiography (ECG), heart-rate variability (HRV) and related assessments to examine how biological systems respond to physical inputs and whether Aires designs can influence those responses.

Early investigations examined patterned applicators and optical filters, establishing an interest in biological regulation that preceded the later mobile-phone applications. Subsequent studies introduced phone-exposure protocols that compared baseline activity, exposure without Aires, exposure with Aires, and recovery. A 2005–2006 publication family reported an investigation involving 53 volunteers; later work included the 2014 journal and conference study and further EEG investigations in 2019 and 2020. Across these reports, investigators described phone-associated changes in selected brain-activity measures and device-associated differences in rhythmic activity, relationships between recording sites, or recovery. [7–9, 21–22, 25, 27, 44]

Heart-rate-variability investigations extended this inquiry to autonomic regulation. The 2013 Defender report and 2020 Shield Pro investigation described changes in selected heart-rhythm measures that investigators interpreted as favorable to adaptation or reduced regulatory strain. Studies involving middle-aged adults, individual physiological case investigations and military cadets broadened the conditions under examination, documenting variation in response and the importance of participants' starting state. [23–24, 26, 28–29]

The recurring questions concern baseline state, response to an exposure, coordination of activity and recovery over time. EEG contributes measurements of brain electrical activity; HRV contributes measurements of heart-rhythm variation relevant to autonomic regulation. Together, these methods give HHS a longitudinal record of human physiological observations and experimental approaches. Appendix B preserves the populations, comparisons and study-specific findings that support this account.

We invite HHS to examine this record alongside the physical research: connecting measured field characteristics with neural and autonomic responses, identifying the conditions associated with favorable changes, and evaluating their practical significance.

Biological findings continue to inform physical investigation

The program's return to physical modeling and materials characterization follows from these biological questions. If response varies with exposure pattern, arrangement and organism state, the engineering task is to characterize the conditions of interaction more precisely.

Recent work includes semiconductor response modeling, thermal-infrared examination of patterned silicon and development of instruments for physiological recording and wireless signal monitoring. The ICICT 2022 modeling paper, published in Springer volume 447 (DOI 10.1007/978-981-19-1607-6_7), develops the semiconductor response model. The ICICT 2026 thermal paper in volume 2029 (DOI 10.1007/978-3-032-28964-3_5) examines the material during heating and cooling. The earlier radiofrequency program measures interaction under radiofrequency conditions. Together, these investigations continue the effort to connect structure, physical response and biological testing across the development of the technology. [31–33]

We ask HHS to consider that cumulative development. A single paper contributes an observation or a method. The program supplies a sustained effort to connect observations across physical scales, biological systems and successive designs. Its record includes different response magnitudes and time courses, which help specify when and how an environmental intervention should be evaluated. Reporting these differences preserves the experimental context and the integrity of the research record.

Question 5 Exposure characterization and evaluation of interventions

Question 5n Assessment and disclosure

The VGTU program measured changes in received radiofrequency fields with different resonator designs, positions and arrangements. The biological program compared exposure and intervention conditions using defined cellular and physiological endpoints. Together, these records show why physical interaction and biological response need distinct, linked descriptions. [13–17, 21–30]

For assessment and disclosure, Aires proposes recording the source configuration, intervention geometry, measured field quantities and biological endpoints together. This would make the conditions behind an observed result available for evaluation and reproduction.

Question 5o Evaluation of mitigation techniques

The Aires record includes existing intervention comparisons for HHS to examine. The 2018 and 2019 rat bone-marrow studies reported fewer chromosome disturbances in router-plus-resonator conditions than with the router alone. Human phone-exposure investigations reported device-associated differences in selected electrophysiological measures. [15–16, 21–22, 25–27]

These findings support further comparative evaluation of field modulation alongside exposure-minimization techniques. The physical quantity changed by an intervention and the biological outcome should be measured separately. Paired measurements would establish whether a particular result accompanies reduced exposure, a change in spatial or temporal field characteristics, or another identifiable mechanism.

Question 5p Characteristics beyond a single exposure value

Geometry and placement affected the VGTU measurements. Duration affected the rat exposure response, while honeybee feeding and memory findings varied with exposure duration and the interval between learning and testing. The record therefore gives concrete reasons to retain spatial configuration and time course alongside frequency, power and absorbed-dose measures. [13–20]

External waveform research examines low-frequency pulsations in wireless-signal power envelopes and provides additional context for temporal characterization. [35] Field coherence and EEG coherence also require separate definitions: one concerns relationships within a field, the other relationships between recorded brain signals.

Questions 7 and 8 Measurement methods and real world conditions

The VGTU investigations used source-and-receiver configurations, signal analysis and measurements at specified positions to examine individual resonators and arrays at radiofrequencies. They reported received signal or field-amplitude changes that depended on the arrangement, including increases and decreases at different positions in the later work. These experiments supply practical examples of spatial characterization relevant to an environmental intervention. [13–14]

The biological studies add complementary methods: EEG spectral and connectivity analysis, ECG-derived HRV, chromosome-aberration scoring, laser-diffraction measurement of erythrocyte osmotic response, behavioral assays and gene-expression analysis. Each measures a particular biological response; its result can be interpreted alongside the corresponding exposure record. [10, 15–30]

The next measurement improvement is to collect calibrated exposure data and biological outcomes in the same protocol. In occupied settings, source activity, background fields, placement and changes over time would be recorded during the biological measurements. This would connect the laboratory methods already used in the program with real-world exposure assessment.

Questions 9 and 10 Disclosure and research data

Aires contributes an archival source of experiment-level evidence: journal articles, conference publications and technical reports containing exposure descriptions, methods, results and device-generation information. The references and appendices identify those records and their relationships. Their value for HHS is to support evidence assessment and the design of subsequent monitoring or longitudinal studies.

For disclosure, the key information is what was tested, under which conditions, against which comparison, and with what measured result. A common study record linking those fields would make findings easier to evaluate across laboratories. Preserving links between original reports, translations and later publications would also prevent multiple versions of one experiment from being counted as separate evidence.

Question 11 Biological susceptibility

The 2019 rat cytogenetic study examined Wistar rats and lines selected for contrasting nervous-system excitability. It reported differences in exposure response and response to resonators relative to the relevant controls. Human investigations examined different ages and starting physiological states, including adults aged 40–60 and younger participants. [7, 9, 16, 25, 28–29]

This record makes starting state and population characteristics relevant to assessment. It supplies an experimental basis for examining susceptibility explicitly, with the population, exposure, endpoint and observation period specified. Studies of the sensitive populations identified by HHS should address their particular circumstances directly.

Question 12 Biological effects and federal exposure limits

The Aires record contributes observations involving mobile phones and Wi-Fi routers: chromosome disturbances in rat bone marrow, changes in human electrophysiological measures, and behavioral, memory and gene-expression responses in honeybees. Several intervention experiments reported attenuation of particular exposure-associated changes when Aires devices were introduced. These findings identify specific experimental responses for HHS to assess. [15–30]

For the question of effects below federal limits, each exposure must be evaluated against the applicable frequency-dependent metric, averaging interval and exposure category. The source specifications and conditions in the cited reports identify the experiments for that assessment; they are not presented as a uniform absorbed-dose or compliance determination across the corpus.

The contribution is evidence at the measured cellular, physiological and behavioral levels, with interpretation attached to the biological system and comparison actually investigated. These endpoints also provide starting points for research on longer-term functional and clinical outcomes.

Questions 13 and 15 Cumulative exposure and wireless infrastructure

The VGTU series examined individual resonators and arrangements of multiple devices under specified source-and-receiver conditions. The measured response depended on geometry and position. This physical work is relevant to how an intervention would be placed and assessed in an occupied environment. [13–14]

Consumer devices, shared spaces and integration into equipment are different deployment contexts for the same environmental thesis. The existing record informs the engineering questions for those contexts; cumulative exposure and infrastructure applications require evaluation in their actual operating configurations. Measurements at occupied locations, source activity and simultaneous sources would connect proximity or antenna density to the exposure experienced over time.

Question 14 Environmental effects

Honeybee research directly contributes to HHS's environmental question. The 2019 publication examined Wi-Fi exposure, feeding motivation and short- and long-term retention of a learned response. Experiments were conducted across two research seasons, with individual exposure durations measured in hours. The results showed that feeding and memory responses varied with exposure duration and the memory interval tested. [18]

The 2020 work extended the inquiry to resonators and magnetic conditions. In its radiofrequency experiment, the short-term memory deficit persisted in the combined router-and-resonator condition, while longer-term retention showed a different pattern. Separate magnetic-field experiments produced further differences between short- and long-term responses. This makes the series informative about the specificity of biological response and the importance of testing the intended outcome directly. [19]

The journal record includes the 2019 honeybee article (DOI 10.1134/S0367144519010039) and the 2020 Integrative Physiology paper (DOI 10.33910/2687-1270-2020-1-3-231-241). A related

experiment examined expression of the stress-responsive hsp70 gene in honeybee brains. It reported lower transcript levels after router exposure and a different response in the router-plus-resonator condition. This adds a molecular endpoint to the behavioral work. [20]

A further step into field settings appears in the publicly described 2023 PACE preliminary report involving 14 beekeepers at 15 locations in Quebec and Ontario. Participants reported colony-condition observations following placement of Lifetune Room devices. This exploratory field record broadens the program to working apiaries and supplies questions for controlled ecological investigation. [42]

The earlier aquatic-organism investigation explored automated analysis of goldfish movement under mobile-phone exposure, with and without an Aires neutralizer, as an environmental-response method. Across these studies, the contribution is a set of approaches for testing exposure effects in living systems beyond humans. The laboratory and field records together identify species, life stage and exposure timing as variables for connecting these assays with ecologically meaningful outcomes. [18–20, 36]

Questions 16 and 17 Research priorities and agency coordination

We recommend a coordinated program that builds on existing experimental observations and evaluates engineered electromagnetic environments as a potential means of modifying biological response.

First, characterize intervention and exposure together. Pair calibrated electromagnetic measurements with biological endpoints in the same experiment. Document the current device generation and test arrangement. This will connect physical interaction with the outcome being investigated.

Second, reproduce the most informative exposure and intervention comparisons. The rat cytogenetic program offers a specific sequence for further evaluation. Human electrophysiology and autonomic measures offer complementary ways to investigate time course and recovery. Independent laboratories should use common protocols and prespecified analyses that retain the biological context of the original work. [15–17, 21–30]

Third, test functional outcomes in defined applications. For personal devices, occupied spaces and integrated equipment, choose outcomes that matter to the application and measure them directly. Research might examine task performance, recovery or sleep, where appropriate to the protocol, while retaining the physical measurements needed to explain the exposure and intervention.

Fourth, investigate susceptibility and environmental biology. Study differences in starting state and response, and extend ecological testing from laboratory endpoints toward organism and population function. The selected rat strains and honeybee series provide concrete precedents. [16–20, 30]

We suggest complementary federal roles: FDA could contribute to methods for evaluating electronic-product exposures and intervention performance; NIH could support mechanistic and translational research; CDC could contribute population-level exposure assessment and longitudinal observation. Shared protocols and reporting formats would allow these activities to inform one another.

The opportunity is to connect existing research capabilities around an actionable question: which measurable changes in an electromagnetic environment produce reproducible, useful changes in biological function, for which organisms, under which conditions?

Question 18 Why HHS should engage Aires

Aires brings HHS a sustained research program that connects physical engineering with biological testing across several levels of organization. The record allows reviewers to follow a question from water and materials experiments, through human red-blood-cell assays and rat bone-marrow cytogenetics, to whole-organism physiology and behavior. It also preserves the exposure conditions, intervention designs and successive investigations that gave those observations their meaning.

This breadth has practical value for HHS. The bone-marrow program supplies a repeatable exposure-and-intervention comparison to examine. Human electrophysiology supplies methods for studying regulation and recovery. Honeybees and goldfish extend the inquiry to environmental biology. Materials studies and field measurements supply the engineering questions that should accompany those assays. Together, they provide concrete starting points for the research priorities described above.

We request a technical briefing with the HHS team responsible for this RFI and the relevant scientific staff at FDA, NIH and CDC. The proposed agenda is to trace the research lineage, review representative exposure-and-intervention protocols, and identify experiments that could most efficiently connect calibrated field measurements with biological outcomes. We welcome discussion of access to the underlying research materials and introductions to contributing researchers, subject to the permissions applicable to each record.

We ask HHS to include engineered electromagnetic environments and field-modulation technologies in its research agenda. Evaluation should cover personal device use, occupied environments and integration into equipment, with the outcomes and measurements specified for each application. This would create a path from the existing experimental observations to the practical exposure and health questions HHS is examining.

For follow-up and a technical briefing, please contact Josh Bruni, CEO, Aires, at josh@airestech.com.

Appendix A Research breadth and attribution

The following institutions are documented as testing sites or author affiliations in primary reports and publications. Historical names are consolidated where they identify the same institution. The list describes the research record and does not imply that each institution participated in every study or endorses this submission.

Institution	Country	Examples in the record
ITMO University	Russia	Silicon models, erythrocyte investigation and materials testing [10–12, 31–33]
Saint Petersburg Electrotechnical University LETI	Russia	Thin films, electromagnetic models and joint publications [2–3, 12, 14, 16, 37–38]
Pavlov Institute of Physiology RAS	Russia	Human electrophysiology, rat studies and honeybee research [9, 15–20, 30]
Vilnius Gediminas Technical University	Lithuania	Direct radiofrequency measurements and joint physical investigation [13–14]
Trent University	Canada	Author affiliation on the 2015 physiological case-study reports [24]
Bekhterev research institute	Russia	Optical-filter and EEG investigation [8]
S M Kirov Military Medical Academy	Russia	Early human investigations, phone-exposure and cadet research [7, 9, 22, 29]
Herzen State Pedagogical University	Russia	Author affiliation on the 2007 silicon modeling work [11]
Saint Petersburg State Polytechnic University	Russia	Aquatic-organism measurement research [36]
Saint Petersburg State University	Russia	Author affiliation on the rat cytogenetics publication [16]
Saint Petersburg State University of Aerospace Instrumentation	Russia	Author affiliation on the rat cytogenetics publication [16]
Grebenshchikov Institute of Silicate Chemistry RAS	Russia	Resonance and materials research [37]
Vavilov State Optical Institute	Russia	Liquid-crystal research [2]
Saint Petersburg Medical Academy of Postgraduate Education	Russia	Early clinical investigation of graphite applicators [6]
Traditional Medicine and Homeopathy Research and Practical Center	Russia	Early applicator trial report [39]

Scope of the research archive

The archive review underlying this response encompassed **97 research-related records**, including journal articles, conference papers, technical reports, translations, related versions and external background materials. These are archival records; related publications and translations of the same experiment are grouped when interpreting the evidence. The **44 numbered reference entries** in this submission identify the research and contextual sources used to present the connected program. They include grouped publication families, a historical record and external methodological context. The counts describe the scope of the archive and the submission, rather than a count of independent experiments.

The conservative contributor count includes more than 50 distinct names appearing as authors or identified researchers in these primary materials. Examples include I N Serov, V I Margolin, V A Moshnikov, S V Koshcheev, A I Maximov, N A Potsar, D B Chesnokova, V A Zhabrev, I A Soltovskaia, V A Tupik, V S Fantikov, M S Potekhin, M G Tomilin, G N Belskaya, A V Alekseytsev, G N Lukyanov, A V Kopyltsov, K A Korshunov, A Jukna, D Jasaitis, V Vasiliauskiene, P Miskinis, J Damauskaite, V V Alexandrov, B V Alexandrov, Y M Balagula, D A Ustavnikov, N A Dyuzhikova, A I Vaido, E V Daev, S V Surma, B F Shchegolev, N G Lopatina, T G Zachepilo, N G Kamyshev, L A Rybina, V N Sysoev, A O Ivanov, M V Alexandrov, V N Ananieva, V A Tarlykov, S V Zenin, S Datova, K Korotkov, M Havas, T G Kuznetsova, S Makarov, A V Konychev, K V Kokorin, T A Koreshkina, A A Fadeyev and S M Kim. [2–3, 5–7, 9–14, 16, 18–19, 21–28, 33, 36–41]

Translations, repeated publications and later manuscripts of the same experiment are treated as related records. External background authors are not counted as Aires researchers. Human participant populations are described at study level.

Appendix B Human EEG and HRV study context

The following notes preserve the populations, comparisons and observations behind the human research narrative. References identify the underlying reports and publication families.

Early functional-state investigations. Patterned-applicator reports examined EEG alongside mood, cognitive or blood measures; the Bekhterev optical-filter investigation examined EEG following structured visual input. These studies used earlier materials and different exposure routes. Findings varied by endpoint and starting state, providing historical context for the later regulation hypothesis. [7–9]

Mobile-phone investigations in the mid-2000s and 2014. The 2005–2006 publication family reported 53 volunteers across EEG and related measurements, describing phone-associated spectral and cross-correlation changes and earlier EEG stabilization in the Aires condition. The related publications represent one research family. The Rybina–Alexandrov report examined EEG with and without Shield. The 2014 Serov–Sysoev study followed standby, call, conversation and recovery stages and reported differences in selected frequency bands; its journal and conference versions describe the same experiment. [21–22, 44]

EEG investigations in 2019 and 2020. The 2019 pilot analyzed six participants and described faster return toward baseline following phone exposure with Shield Pro. The 2020 phone-exposure report described lower alpha power under phone-only exposure and higher alpha power with the resonator in a selected comparison. These reports examined regional activity and differences between participants. Their electrophysiological findings provide questions for direct tests of functional performance. [25, 27]

Heart-rate variability. Datova's 2013 report studied 13 volunteers aged 40–59 before and after 20 minutes of Defender use, without an imposed phone challenge. The calculated regulatory-stress index decreased in 12 of 13 participants. Kuznetsova's 2020 report studied 15 young men across baseline, phone-related and Shield Pro conditions, reporting increased RR-interval variability and a lower calculated regulatory-stress index with the device. Each report interprets changes in relation to its own protocol. [23, 26]

Individual physiological observations. The two 2015 Havas reports concern separate participants and combine HRV with other cardiovascular measurements. Selected pulse-wave indices changed favorably in device-associated conditions, while other measures showed mixed responses. These are exploratory individual observations. [24]

Adults aged 40–60. The 2020 Personal Protection report enrolled 18 adults without an imposed phone challenge; the reported alpha analysis included 11. Selected frontal absolute-alpha-power comparisons were significant, while relative alpha power and frequency comparisons were not. EEG measures returned toward baseline within minutes after device use. [28]

Military cadets. The 2024 investigation recruited 24 participants and used smaller subsets for the reported analyses. Participants began within physiological norms; the report describes brief phone-associated activation followed by recovery. Principal EEG and HRV comparisons were not statistically significant. Selected coherence and subjective observations were exploratory. The study adds information about baseline state and recovery in this population; the related 2025 manuscript describes the same investigation. [29]

Supporting research references

English titles below identify the original reports or translate publication titles. DOI and journal identifiers locate published work; each numbered entry links to its supporting documents in the evidence index. The narrative is based on the underlying reports, with methods and results attributed to the study concerned. References 34 and 35 provide external methodological context. The [Aires HHS evidence index](#) provides source documents, language and version labels, and the public account for reference 42. Public copies of reports containing participant identifiers have those identifiers removed.

- [1] Aires Human Genome Research Foundation. Aires Project Financial Report and summary of product development expenditures for 1992–2017. Historical organizational record, 2017. Used here for program chronology. [Source documents](#)
- [2] Tomilin MG, Serov IN, Margolin VI, Soltovskaya IA, Belskaya GN, Alekseytsev AV. A new phenomenon of discrete formation of nematic liquid-crystal droplets induced by fractal-matrix resonators. Russian research article, 2002. Aires archive. [Source documents](#)
- [3] Serov IN, Margolin VI, Moshnikov VA, Koshcheev SV, Maximov AI, Potsar NA, Chesnokova DB. Investigation of the influence of fractal-matrix resonators on the structure of copper films. *Physics and Chemistry of Materials Treatment*. 2003;(2):16–20. Russian publication; Aires archive. [Source documents](#)
- [4] Serov IN, Slesarev VI, Shabrov AV. Structural and informational state of water and the effect of Aires fractal-matrix structurizers. *Bulletin of the Saint Petersburg Mechnikov State Medical Academy*. 2002;(3):124–131. Aires archive. [Source documents](#)
- [5] Zenin SV. Investigation of the protective action of Aires Shield, Aires Defender and Aires AquaCluster against electromagnetic radiation effects on the structural state of an aqueous environment. Research report, 2013. Date follows the report title page. [Source documents](#)
- [6] Konychev AV, Kokorin KV, Koreshkina TA. Clinical medical trials of the Aires matrix applicator. Saint Petersburg Medical Academy of Postgraduate Education, 2000. Research report. [Source documents](#)
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- [8] Bekhterev research institute. Testing the clinical and neurophysiological effect of optical filters bearing fractal matrix topology. Research report, 2002; study conducted December 2001–March 2002. [Source documents](#)
- [9] Rybina LA, Ivanov AO, Alexandrov MV. Changes in spontaneous brain bioelectrical activity during BIP therapy and resonance BIP therapy in patients with stress-related asthenoneurotic disorders. Linked research reports, early 2000s; undated archival document. Pavlov Institute and S M Kirov Military Medical Academy. [Source documents](#)
- [10] Tarlykov VA. Study of the effect of the Aires fractal resonator on erythrocytes in human blood. Saint Petersburg State University of Information Technologies, Mechanics and Optics, 2005. Research report. A later archival version presents the same investigation. [Source documents](#)
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