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Biophysical Studies with Liquid Model Systems during the Conditions of Electric Corona Discharge and NaCl Solution

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The effects of biophysical fields on water and model systems of aqueous solutions have been investigated. In two of three experimental models, an electric field was applied under conditions of corona gas discharge. The biophysical influence was exerted on 120 mL water samples. Following exposure to the biophysical fields, drops of the treated water were analyzed using corona gas discharge at the air-liquid interface. The control sample comprised water drops that were not

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exposed to biophysical fields. In the first method, the corona glow was examined as a function of the dielectric permittivity of the water. In the second method, brightness histograms of the corona discharge were analyzed. The third experimental approach utilized a physiological solution containing 0.9% sodium chloride (NaCl). The comprehensive analysis, incorporating these three methodologies, facilitates a robust evaluation of the effects of biophysical fields on liquid systems.

Keywords: Corona electric discharge; water parameters; histogram; brightness.

1. INTRODUCTION

Living organisms are characterized by a highly organized molecular and cellular architecture, with life processes intricately regulated at these levels. Among the fundamental biophysical parameters of living organisms is bioelectric activity. This activity arises from bioelectric potentials generated by various cells and plays a crucial role in medical diagnostics, mainly through electrocardiography (ECG) and electroencephalography (EEG). ECG measures the hearth's electric activity over time, utilizing a standard configuration of 12 leads strategically placed on the body. Essential diagnostic parameters derived from ECG include heart rate, P-wave duration, PR interval, QRS complex duration, QT interval, and ST segment. The amplitude of ECG signals typically ranges from 0.1 to 5 mV, with a frequency spectrum extending from 0.05 to 100 Hz.

EEG, monitors the brain's electric activity through electrodes positioned on the scalp. Key features analyzed in EEG include waveforms categorized frequency into delta, theta, beta and gamma waves, spanning a range from less than 4 Hz to greater than 30 Hz. The amplitude of these signals generally falls within 10 to 100 µV. EEG data is frequently exanimated for characteristic patterns, such as event-related potentials, background rhythms, and abnormal spike activity.

"Human tissues emit weak electromagnetic waves. These are determinate by ion by ion concentrations (e. g. K^+, Na^+, Cl^-). The ion concentrations permeability across cell membranes with typical ranging from 50-80 mV in the human body" (Ussing, 1949).

"The electromagnetic fields (EMFs), categorized under non-ionizing radiation (NIR), do not generate ions of its emission but cause biological effects" (Ng, 2003).

In 1983, Gulyaev and Godik from the former USSR conducted pioneering studies on biophysical fields emitted by humans. These biophysical fields encompass key components such as electromagnetic and acoustic fields. Gulyaev and Godik introduced the general concept of "physical fields of biological objects" (Gulyaev & Godik, 1984; Gulyaev & Godik, 1991). Ignatov and Antonov defined "biophysical fields of man" (Ignatov et al., 1998).

Human vital functions are maintained at a skin temperature of approximately 36.6 °C, with deviations often signaling pathological conditions. Through thermographic methods, Gulyev and Godik recorded infrared radiation emitted by the human body. This infrared radiation has since been applied in medical diagnostics, particularly thermographic imaging (Brashevan et al., 1997).

Gulyaev and Godik demonstrated that the human body also emits acoustic fields. Furthermore, they identified that human skin emits light across multiple spectral ranges, including near-ultraviolet, visible, and near-infrared regions – a phenomenon termed "chemiluminescence."

This research also provided evidence of radio thermal emissions originating from internal organs.

These findings laid the groundwork for advancements in medical diagnostics based on biophysical field analysis, emphasizing human biological systems' diverse electromagnetic and acoustic properties.

"Human skin interacts with electromagnetic waves across the near-ultraviolet, optical, and near-infrared ranges. The skin's infrared thermal biofield predominantly falls within the middle infrared spectrum, covering 8 to 14 µm wavelengths. The peak intensity of this radiation occurs at a wavelength of approximately 9.7 µm when the skin temperature is around 36.6 °C. At this temperature, the skin's infrared radiation closely resembles that of an absolute black body (ABB) at the same temperature. Infrared radiation penetrates the skin to a depth of about 0.1 mm and reflects a governing reflection in the visible spectrum according to the physical principles. When absorbed, the energy from the radiation interacts with and influences the underlying tissues" (Ignatov et al., 2015).

"Gulyaev and Godik determined that the skin's threshold sensitivity to infrared radiation is approximately 10^{-14} W cm^{-2}. A physiological response to the thermal current is elicited when thermal stimuli reach this threshold. The intensity of the thermal radiation emitted by the skin is approximately $2.6x10^{-2}$ W cm^{-2}" (Gulyaev & Godik, 1984; Gulyaev & Godik, 1991; Ignatov et al., 1998).

Ultraweak emissions or biophotons from biological objects are present (Young & Roper, 1976; Popp et al., 2002; Cohen & Popp, 1997).

"The typical observed emission of biological tissues in the visible and ultraviolet frequencies ranges from 10^{-19} to 10^{-16} W cm^{-2} (~1–1000 photons·cm^{-2}·sec^{-1})" (Edwards et al., 1989; Choi et al., 2002; Niggli, 1993).

The measurement of weak electromagnetic waves from biological objects has a history involving plant bulbs. In the 1920s, the scientist Gurwitsch from the former USSR conducted experiments with bulbs, demonstrating that a weak ultraviolet emission could be observed between them (Gurwitsch, 1923). In the modern era, biophoton emission is associated with process such as seed germination (Paolis et al., 2024).

"The energy of hydrogen bonds in water is influenced by chemical substances and external fields, resulting in the restructuring of water molecules and alterations in the physical properties of water and aqueous solutions" (Bhattacharyya et al., 2022). Biophysical fields, in particular, have been shown to affect the energy of hydrogen bonds, contributing to these changes. Research has been conducted to investigate the role of water as a sensor for weak electromagnetic fields (Lobyshev, 2005), with studies analyzing weak low-frequency electromagnetic oscillations in water (Liboff et al., 2017). Since the latter half of the 20^{th} and 21st centuries, investigations have focused on water behavior under corona electric gas discharge conditions.

"The Ignatov method compares the electric photon emission of a water sample containing dissolved substances or subjected to external influences with that of a control sample" (Ignatov, 2005; Marinov & Ignatov, 2008; Ignatov et al., 2021).

This method has also been applied in color corona spectral analysis to study of substances such as calcium carbonate (Ignatov et al., 2025).

"Pesotskaya, Glukhova, and co-authors hold patents and have published extensively in this area" (Pesotskaya et al., 2013; Glukhova, 2014; Ignatov et al., 2025). They are credited with developing the histogram method, which enables quantitative analysis of physical and chemical processes. Before histogram analysis, liquid drops are exposed to external fields or chemical substances. Subsequently, the drops are activated using corona electric discharge at the air-liquid interface. The histogram method examines the brightness and pixel distribution of the resulting images, enabling detailed quantitative evaluation. The analysis includes two parts. The first part is diving the image's brightness into predefined intervals (e.g., from black to white). The second part is counting the number of pixels within each brightness interval to generate a histogram. This methodology facilitates the detailed investigation of the interactions and transformations in water and aqueous systems, underlining its importance in physical, chemical, and biological studies.

"The resulting data is presented as a graph (histogram) that shows the brightness distribution" (Ignatov et al., 2024).

Annelies Nijman influenced the model systems with voice energy. Different proofs were published for the effects of songs on human health and model systems (Saldias et al., 2020; Lopez et al., n.d.). The corona coronal glow was investigated with the method of Gas Discharge Visualization (GDV) (Cornale et al., 2023; Korotkov, 2014).

"The investigation aims to analyze the effects of Annelies Nijman's voice energy's biophysical fields on the two liquid model systems: water influenced by corona electric discharge and estimation of electric parameters and brightness and a solution of 0.9% NaCl with pH results" (Ignatov et al., 2024).

2. METHODS AND MATERIALS

2.1 Color Corona Electric Discharge

The color glow from Annelies Nijman's thumb was studied under conditions of electric corona discharge (Ignatov et al., 2015; Ignatov, 2005; Marinov & Ignatov, 2008; Ignatov et al., 2021). The investigation was performed in a dark room with a temperature of 25 °C and a humidity of 65%. The recording medium was color Kodak film on a cylindrical transparent electrode with r=3.5 and h=3.5 cm. The electrode is made from glass and plastic material. The electrode is filled with a conductive 1% solution of sodium chloride in distilled water. The electric parameters of the device are: U=12 kV; I=10 mA, f=15 kHz. The scheme is published in (Ignatov et al., 2015; Ignatov, 2005; Marinov & Ignatov, 2008; Ignatov et al., 2021).

A corona gas discharge was activated in the gap between the studies objects and the transparent electrode. The resulting glow is localized within and around contact area of the thumb or water or solution drop. The electromagnetic spectral range is 380-495 and 570-750 nm (Ignatov et al., 2015; Nevoit et al., 2024; Antonov, 1995).

The spectral characteristics of this emission were quantified in terms of electron volts (eV), providing insights into underlying physical and chemical processes.

2.2 Histogram Method for Electric Corona Images' Brightness

The Histogram method for electric corona images' brightness is patented (Pesotskaya et al., 2023) and the object of scientific articles (Pesotskaya et al., 2013; Glukhova, 2014; Ignatov et al., 2025).

Before the histogram analysis, the liquid drops are objects of dissolving of chemical compounds or objects of influence with fields. After that, the drops are activated with corona electric discharge from contact medium air-liquid. The images are reordered on black-white X-Ray photographic films. The analyses were done using the computer program Python.

The histogram method analyzes images' brightness and pixel distribution, enabling a quantitative investigation of physical and biological processes. Using this method:

1. The image's brightness is divided into intervals (or categories) from black to white.
2. the number of pixels falling within the corresponding brightness range is recorded from each interval.
3. The resulting data is presented as a graph (histogram) that shows the brightness distribution.

3. RESULTS

3.1 Results with Coronal Electric Discharge Spectral Analysis

Coronal gas discharge's electric and dielectric parameters were described in (Ignatov et al., 2015; Antonov, 1995). Fig. 1 shows the result of Annelies Nijman's thumb corona discharge.

The emission Annelies Nijman is with violet color or E=3.03 eV. The distinctive violet color is indicative of highest energy level, potentially linked to the biophysical field emitted during the experiment. The results confirm that the corona discharge spectral analysis is a sensitive reliable method for detecting suitable biophysical emission from the thumb.

Fig. 1. Color corona image of thumb of Annelies Nijman

3.2 Results: Median Brightness of Water Drops Post-corona Discharge

The method analyzes the median brightness of water drops following corona discharge, as recorded on black-and-white X-ray photographic films.

Fig. 2 illustrates the results on the corona glow of water drop influence with voice energy of Annelies Nijman and control sample (Fig. 3) without influence.

Fig. 4 illustrates the brightness distribution of water drop influence with the voice energy of Annelies Nijman and the control sample (Fig. 5) without influence.

Fig. 6. presents comparative analysis of the difference in median brightness between Annelies Nijman results and the control sample.

These findings suggest that the biophysical field influences not only the corona glow but also the optical properties of water drops. The increased brightness likely reflects molecular or structural changes in the water, such as hydrogen bond rearrangement, induced by the biophysical field.

3.3 Results with 0.9 % Solution of NaCl

One of the co-authors, Gluhchev, performed the study.

The results obtained by Annelies Nijman are shown in Table 1.

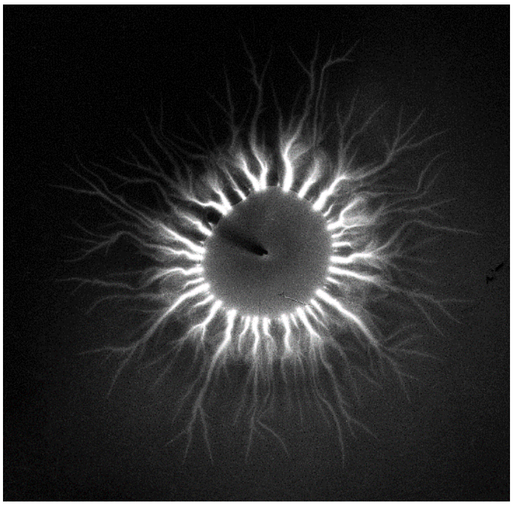

Fig. 2. Image of corona glow of Annelies Nijman

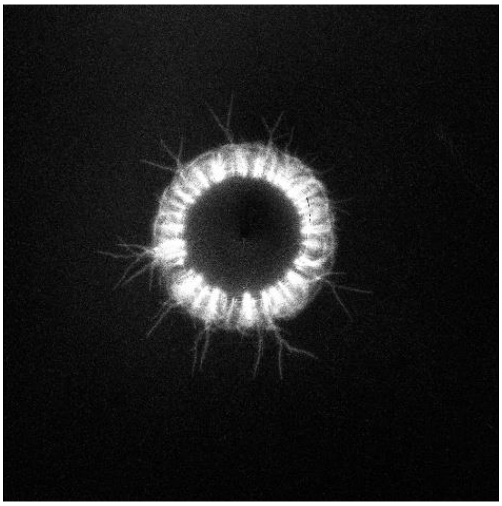

Fig. 3. Control sample

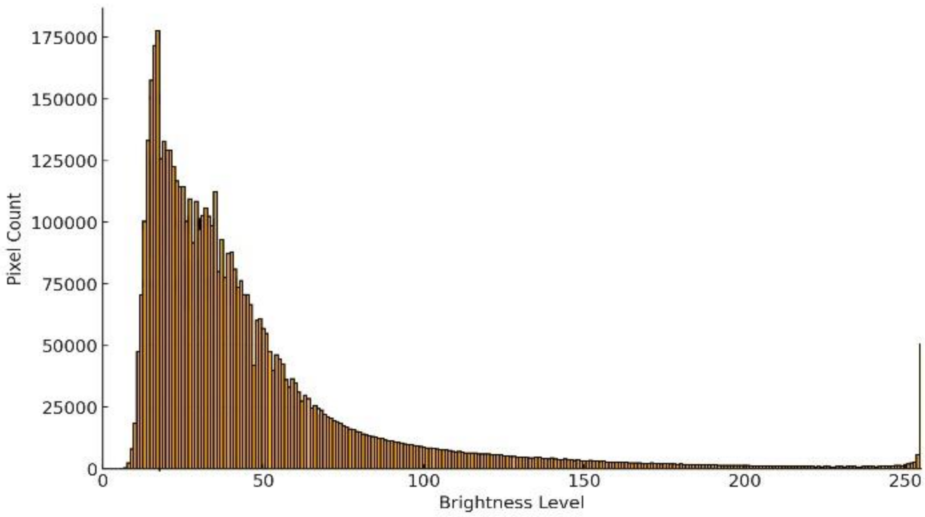

Fig. 4. Brightness after the bioinfluence of Annelies Nijman on liquid

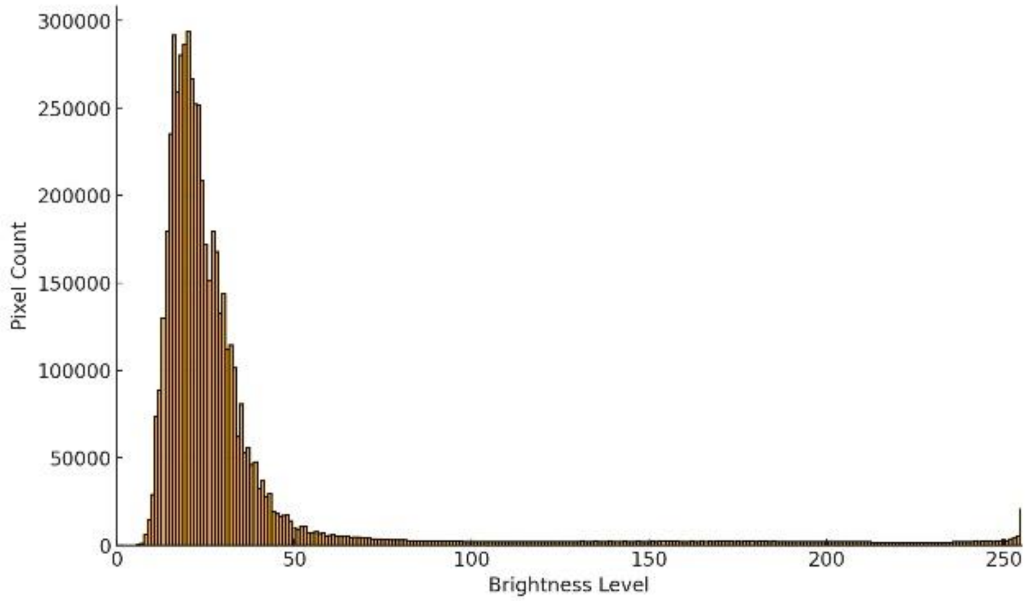

Fig. 5. Control sample result of the liquid drop

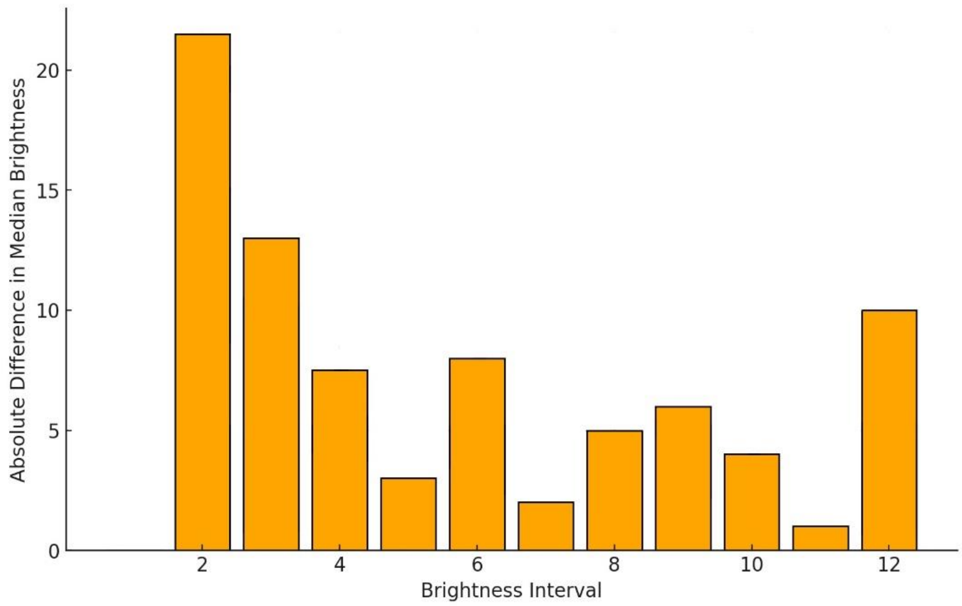

Fig. 6. Comparative analysis of the difference in median brightness between Annelies Nijman results and the control sample

Table 1. Results with pH and values of hydrogen ions

	pH	Values of the hydrogen ions (H^+) (mol L^{-1})
Control sample	6.97	1.03 $x10^{-7}$
Sample	6.10	$7.74x10^{-7}$
Difference	0.87	$6.71x10^{-7}$

A difference from Table 1 of of the test sample relative to the control one was established. This indicates $6.71x10^{-7}$ mol L^{-1} increase in hydrogen ions (H^+) in the sample after the influence. This result highlights the chemical effects if the biophysical field, which likely induces a shift in the equilibrium of water dissociation, leading to increased H^+ ion activity.

The changes observed in the NaCl solution align with earlier findings that external fields can influence ionic behavior in aqueous solutions. These results have significant physiological relevance, as ionic concentrations and pH variations can directly impact biological processes and cellular activity.

Combining the three experimental methods comprehensively evaluates the biophysical field's effects on liquid systems. The corona spectral analysis detects changes in the dielectric properties of the object's electric corona photon emission, the histogram method quantifies alterations in brightness, and the pH measurements of a 0.9% solution of NaCl confirm chemical changes in ionic activity. These methods validate that biophysical fields can induce measurable physical and chemical changes in liquid systems.

The observed phenomena can be attributed to biophysical fields' ability to influence molecular and ionic interactions in liquid systems. The increased energy observed in the corona discharge spectral analysis, the optical changes in brightness, and the chemical variations in pH suggest a complex interaction between biophysical fields and the structural and chemical properties of water and aqueous solutions. These effects may involve the reorganization of the hydrogen bonding network, changes in dielectric properties, and modifications in ion activity.

4. CONCLUSIONS

This study used two analytical methods to investigate the effects of biophysical fields on water and 0.9% NaCl solution models.

It explored the electric corona emissions associated with the voice energy of Annelies Nijman.

1. Color corona photon emission analysis. The analysis identified an electric biophoton emission of 3.03 eV.
2. Brightness histogram analysis. Median brightness levels of water drops exhibited significant differences following biophysical exposure, indicating structural and optical changes in the liquid.
3. Hydrogen ion analysis and pH: The 0.9 % NaCl solution showed a measurable increase in hydrogen ion concertation (up to $6.71x10^{-7}$), reflecting chemical alterations under the influence of biophysical fields.

These findings highlight Annelies Nijman's ability to induce measurable physical and chemical changes in liquid systems through voice energy.

In conclusion, the study demonstrates that biophysical fields have a quantifiable impact on liquid systems, influencing their corona discharge spectral, optical, and chemical properties. Integrating corona discharge spectral analysis, histogram methods, and pH measurements provides a comprehensive framework for examining these effects. These results pave the way for further exploration of biophysical phenomena and their potential applications.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Antonov, A. (1995). *Research of the non-equilibrium processes in the area of allocated systems* (Doctoral dissertation thesis for degree “Doctor of Physical Sciences”, Blagoevgrad, Sofia).

Bhattacharyya, S., Pal, S., & Banerjee, A. (2022). Biophysical analysis of water exposed to meditative energy field using UV-Vis spectroscopy. *Water, 13*(5).

Brashevan, Y. V., Zavadskii, Y. I., Zinis, K. A., et al. (1997). Optoelectronic system for dynamic monitoring of thermal fields in medical diagnostics. In *Proc. SPIE 3200, Third Conference on Photonic Systems for Ecological Monitoring* (pp. 1-12). https://doi.org/10.1117/12.284731

Choi, C., Woo, W. M., Lee, M. B., et al. (2002). Biophoton emission from the hands. *Journal of the Korean Physical Society, 41*, 275–278.

Cohen, S., & Popp, F. A. (1997). Biophoton emission of the human body. *Journal of Photochemistry and Photobiology B: Biology, 40*(2), 187–189. https://doi.org/10.1016/S1011-1344(97)00050-X

Cornale, S. S., Patil, S. S., & Deo, A. (2023). A systematic review of human biofield image analysis using image processing techniques. *Journal of the Oriental Institute, M.S. University of Baroda, 72*, 87-103.

Edwards, R., Ibison, M. C., Jessel-Kenyon, J., & Taylor, R. B. (1989). Light emission from the human body. *Complementary Medicine Research, 3*, 16.

Glukhova, N. (2014). Development of express-evaluation method of water biological properties. *East-European Journal of Enterprise, 6*, 18-25. https://doi.org/10.15587/1729-4061.2014.31546

Gulyaev, Y. V., & Godik, E. E. (1984). On the possibilities of the functional diagnostics of the biological subjects via their temporal dynamics of the infrared images. *USSR Academy Nauk Proceedings/Biophysics, 277*, 1486-1491.

Gulyaev, Y. V., & Godik, E. E. (1991). Functional imaging of human body. *IEEE Engineering in Medicine and Biology, 21*-29. https://doi.org/10.1109/51.107165

Gurwitsch, A. G. (1923). Die natur des spezifischen erregers der zellteilung. *Archiv für Entwicklungsmechanik der Organismen, 100*, 11–40.

Ignatov, I. (2005). *Energy Biomedicine*. ICH.

Ignatov, I., Antonov, A., & Galabova, T. (1998). *Medical biophysics – biophysical fields of man* (pp. 1-71). Gea Libris.

Ignatov, I., Antonov, A., Neshev, N., Niggli, H., Stoyanov, C., & Drossinakis, C. (2021). Color coronal spectral analysis of bioelectrical effects of humans and water. *Contemporary Engineering Sciences, 14*(1), 61-72.

Ignatov, I., Drossinakis, C., & Ignatov, A. I. (2025). Color coronal spectral analysis: Results with water solution of calcium carbonate. *Portugaliae Electrochimica Acta, 43*(2), 113-126. https://doi.org/10.4152/pea.2025430203

Ignatov, I., Mosin, O. V., Niggli, H., Drossinakis, C., & Tyminsky, G. (2015). Methods for registering non-ionizing radiation emitted from human body. *European Reviews of Chemical Research, 1*(3), 4-24. https://doi.org/10.13187/ercr.2015.3.4

Ignatov, I., Pesotskaya, L., & Glukhova, G. (2024). Biophysical results with liquid model systems. *Contemporary Engineering Sciences, 17*(1), 35–46. https://doi.org/10.12988/ces.2024.93127

Ignatov, I., Pesotskaya, L., Glukhova, N., et al. (2025). Registration of different types of water with corona gas discharge effects and parameters of brightness. *Portugaliae Electrochimica Acta, 43*(4), 217-224. https://doi.org/10.4152/pea.2025430401

Korotkov, K. G. (2014). *Science of measuring energy fields: A revolutionary technique to visualize energy fields of humans and nature*. Bioelectromagnetic and Subtle Energy Medicine, 111-120.

Liboff, A. R., Poggi, C., & Pratesi, P. (2017). Weak low-frequency electromagnetic oscillations in water. *Electromagnetic Biology and Medicine, 2*, 154-157. https://doi.org/10.1080/15368378.2016.1227332

Lobyshev, V. I. (2005). Water is a sensor to weak forces including electromagnetic fields of low intensity. *Electromagnetic Biology and Medicine, 24*(3), 449–461. https://doi.org/10.1080/15368370500382248

Lopez, L. S., Marrero, N. P., & Rodrigues, T. R. Applicability of resonance tube phonation in water for semi-occluded vocal tract voice training and therapy. *Folia Phoniatrica et Logopedica*. https://doi.org/10.1159/000499566

Marinov, M., & Ignatov, I. (2008). Color Kirlian spectral analysis. Color observation with visual analyzer. *Euromedica*, Hanover, 57-59.

Nevoit, G., Bumblyte, I., Korpan, A., et al. (2024). The biophoton emission in biotechnological and chemical research: From meta-epistemology and meaning to experiment. Part 1. *Ukrainian Journal of Physics, 69*(3), 190-206. https://doi.org/10.15407/ujpe69.3.190

Ng, K.-H. (2003). Non-ionizing radiations – sources, biological effects, emissions and exposures. In *Proceedings of the International Conference on Non-Ionizing Radiation at UNITEN (ICNIR2003),* *Electromagnetic Fields and Our Health* (pp. 20-22).

Niggli, H. (1993). Artificial sunlight irradiation induces ultra-weak photon emission in human skin fibroblasts. *Journal of Photochemistry and Photobiology B: Biology, 18*(2–3), 281–285. https://doi.org/10.1016/1011-1344(93)80076-L

Paolis, L. D., Francini, R., Davoli, I., et al. (2024). Biophotons: A hard problem. *Applied Sciences, 14*(13), 5496. https://doi.org/10.3390/app14135496

Pesotskaya, L. A., Churilov, V. V., Glukhova, N. V., et al. (2023). Device for registration of gas discharge glow of various objects “RGS-1”. Patent Ukraine, 37.

Pesotskaya, L. A., Glukhova, N. V., & Lapitskiy, V. N. (2013). Analysis of the images of the water drops Kirlian glow. *Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 1*, 91-96.

Popp, F. A., Chang, J. J., Herzog, A., Yan, Z., & Yan, Y. (2002). Evidence of non-classical (squeezed) light in biological systems. *Physics Letters A, 293*(1-2), 98-102. https://doi.org/10.1016/s0375-9601(01)00832-5

Saldias, M., Guzman, M., & Sandoval, G. (2020). Water resistance therapy as vocal warm-up method in contemporary commercial music singers. *Folia Phoniatrica et Logopedica, 72*(1), 1–12. https://doi.org/10.1159/000494722

Ussing, H. H. (1949). Transport of ions across cellular membranes. *Physiological Review, 29*(2), 127-155. https://doi.org/10.1152/physrev.1949.29.2.127

Young, R. E., & Roper, C. F. (1976). Bioluminescent countershading in midwater animals: Evidence from living squid. *Science, 191*(4231), 1046-1048. https://doi.org/10.1126/science.125121

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