

# WATER – A Multidisciplinary Research Journal

A Partnership with IPWS – International Panel on Water Structure

*Special Edition for the 9th World Water Forum, Dakar, Senegal*

ABSTRACTS BROCHURE | March 2022



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This Special Edition of *WATER – A Multidisciplinary Research Journal* is dedicated to Dr. Luc Montagnier (1932-2022), Nobel Prize winner in 2008, who dedicated his scientific life to virology and the development of vaccines for AIDS. He inspired scientists worldwide to work in a fair play manner without fear of facing an open discussion on critical subjects even when being misunderstood; to be bold but humble; and to always focus on the benefits for humanity and the planet.

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## The Transdisciplinarity of Water

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### About This Issue

In 2019, my colleague Ivana Suffredini and I, a professor at the Graduate Program in Environmental Pathology at University Paulista, São Paulo, Brazil, carried out an exciting task. It was a proposition to master's and doctoral students to encourage elementary school students to prepare a science fair whose theme was "water." For four months, the graduate students guided nine- and ten-year-olds to conduct experiments, build models, and create music and dance presentations on the topic, based on each group's interests and natural aptitudes. The result was surprising, given the realization of the magnitude of children's awareness of complex issues involving the molecular structure of water in its different states; the importance of basic sanitation and the quality of water for consumption and for the environment; the hegemony of water in the composition of living beings; and the need to build new resources for the sustainable use of water.

In 2020 I received an invitation from Dr. Sergio A. Ribeiro, Director General of CIRAT, to compose the IPWS and organize this special edition for the 9th World Water Forum to be held in Dakar, Senegal, in March 2022, in partnership with the journal WATER – A MULTIDISCIPLINARY RESEARCH JOURNAL, and with the support of Prof. Gerald Pollack, its Editor-in-Chief. I gladly accepted the challenge, and for almost two years, we embarked on a multi-step process to offer readers a sample of how frontier science can signal a very different and much more exciting future than just our presence in other countries. This science is represented in the

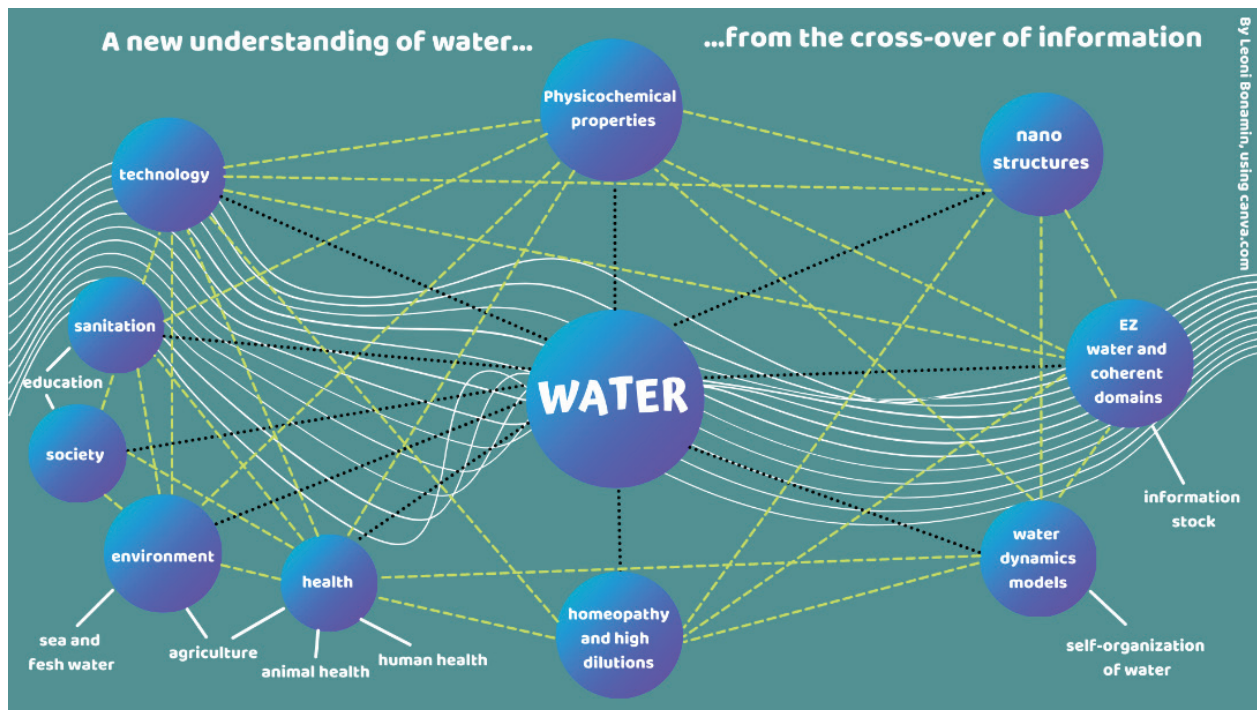
words sustainable, non-violent, empathetic, and triple healthy, involving humanity, the animal world, and the environment.

Interestingly, when reading the articles sent by the participating authors, I revisited the same themes that had emerged from the children's creativity a year earlier, as if everything had taken shape: the molecular structure of water, the importance of basic sanitation; new ways to improve the quality of water; and its role in human, animal, and environmental health. I realized that these were not topics for the future. The future is today!

This Special Edition of WATER aimed to disclose advanced knowledge about water at different structural levels, leading to a new understanding of water in response to the challenges of our century. The focus was on the cross-over of information with technical quality and bold thinking, as shown in the diagram below.

The objective herein was to gather scientific quality and allow the authors to propose and discuss hypotheses based on the literature defined by the purposes of this project. For this, the manuscripts were initially received after general, but personal invitations were made to more than 200 researchers in the field, whose contributions were evaluated in a pre-selection based on the scope of WATER; they then went through a thorough two-step peer review process.

In the first stage, ad-hoc reviewers were invited to give their opinions. In the second stage, members of the Editorial Board carried out a new detailed analysis of the content to ensure maximum scientific understanding, which is



fundamental when it comes to science of the frontier, allowing the authors to be bold in their projects, but at the same time careful with the methodology. Parts of the discussion between authors and reviewers composed the item "Discussion with the Reviewers (DWR)" at the end of each article, following the authors' selection criteria. It is an initiative that enriches reflections on the topics addressed and is in harmony with the concept of open science. From the Board's organization to the design of the editorial flow to peer review, this entire process was carried out voluntarily by all the actors involved.

Then, the articles approved at this stage were reviewed by a professional for final adjustments in English grammar and style. This service was courtesy of IPWS – CIRAT offered to participating authors. WATER professionals carried out the article production stage meticulously, with the third layer of revisions focusing on form and graphic art.

The entire editorial process was philanthropic, there were no costs for the authors, and all WATER articles were published as open access. Authors from five countries participated in this project: Brazil, India, Italy, Russia, and the United States. Given the multidisciplinary nature of this Special Edition, the sequence of articles was organized following a well-defined logic: from the broadest to the most specific topics, culminating in innovative proposals, with the possibility of immediate application. For this,

different sessions were organized according to the topics: "Opinion Article," "Hypotheses," "Water Structure," "High Dilutions," "Water and Environment," and "New Devices."

In an opinion article, Palavizini and colleagues surveyed the historical and cultural nature of water that challenges researchers so much, from its role in health and lifestyle to profound questions that emerge from the quest to understand its properties. Physicochemical properties, including the role of water in the imagination of different generations and civilizations were presented. Finally, the authors trace a faithful portrait of the transdisciplinary profile of water.

Then, two complementary articles deal with the hypotheses about the physical properties of water and high dilutions, associated with the concept of quantum electrodynamics (QED) proposed by Emilio Del Giudice, Giuliano Preparata, and Giuseppe Vitiello in the late 1980s. Manzalini and Galeazzi propose the hypothesis "The Quantum Nature of Biological Intelligence," in which adaptive processes typical of living organisms could be defined, in essence, as an expression of biological intelligence, which would operate through "symmetry breaking" phenomena, an extension of the principles of biological intelligence. Nandy and collaborators adopted the concept of QED as an explanatory hypothesis to understand the different properties of water; these changes from the most common ones, such as hydration

and cleaning, to those lesser known, for example, treatment of diseases and generation of electric energy, whose mechanisms are still not wholly explained by current science.

Still, on evidence of the structure of water, three more articles stand out. In Yakhno and Yakhno, a series of insightful and straightforward experiments were carried out employing optical microscopy, in which diverse sediments formed by the evaporation of saline solutions and suspensions of hydrophilic solid particles reveal the identification of dispersive patterns, which can be defined mathematically. Such patterns suggest two water phases under these conditions: continuous and structured water, which occur near hydrophilic surfaces. Singh *et al.* follow the same reasoning but with a more refined methodology, using two complementary types of spectroscopies. Thus, very high dilutions of different molecules could be distinguished from each other by the amount of free water in the solution and the strength of the hydrogen bonds present in hydroxyl radicals that are formed during their preparation. In Konovalov *et al.*, nonlinear changes in conductivity, pH, and redox potential were observed at high dilutions, representing dispersed self-organizing systems. In this article, it appears that such processes can be potentiated through the so-called “supramolecular technique method,” developed by Luciano Gastaldi, which opens perspectives for its practical use, especially in agriculture.

Three more articles deepen the discussion of high dilutions. Lobyshev identified non-monotonic impedance patterns in highly diluted diclofenac preparations subjected to vigorous agitation. Such standards are not related to the solute concentration itself but to the sample treatment, being stable for up to 30 days. Zanco made a brief review of basic research at high dilutions and then proposed two non-invasive diagnostic methods (low-power laser and cold plasma imaging), which can be used as tools to assess the germination capacity of seeds, pre-treated with highly diluted substances, a promising resource for high-performance agriculture. Nagai *et al.* carried out a systematic review of the literature, rescuing studies on the treatment of aquatic organisms with high dilutions of active substances, which are suitable animal models for understanding their mechanisms. Among the studies surveyed, those conducted over 20 years with changes in the rate of metamorphosis in tadpoles stand out. Biological models have been associated with water physicochemical changes after high dilutions

exposure. The set of these three articles shows different perspectives on the physical properties of water used in the preparation of high dilutions subjected to vigorous agitation and its impact on biological events. It represents an essential contribution to understanding the mechanisms involved in homeopathic treatment, a topic that is usually controversial in the scientific mainstream but finally finds a way of elucidation.

Finally, Mohammad *et al.* and Souza *et al.* show practical aspects of water structuring. In the first case, thirty-six experiments were carried out with *Artemia salina* and showed that water agitation could facilitate the adaptive processes of brine shrimp embryos to reduce hatching at low concentrations of mercury chloride, and circalunar variations modulated this effect. It suggests an increase in the bioresilience capacity of these organisms to toxic agents. In the second case, the magnetic induction of irrigation water for corn seeds under field conditions modified the germination percentage, although there were no changes in the other parameters studied. It is an inviting study for further research in the area, with the potential for significant impacts on agriculture. The last article of this Special Edition shows a perspective for application in short to medium terms, thus closing the cycle proposed at the beginning of the project: to bridge the gap between basic research on the physicochemical aspects of water structuring and applications with immediate potential. Thus, Jabs and Rubik propose the creation of low-cost/low-tech/low-maintenance design equipment that can be built with relative technical simplicity for the supply of mineralized and structured drinking water in areas of great need. This initiative inspires us to envision the possibility of offering quality water in various regions of the planet with minimal investment, which can reduce social gaps and improve the quality of life fairly and universally.

**Prof. Leoni V Bonamin, DVM, PhD**

*University Paulista – UNIP, Brazil*

*Guest Editor of WATER for this Special Edition*



## About IPWS in the WWF Context

Water plays a vital role in adapting natural and human systems in a climate change scenario, so understanding how this fundamental element of life is organized and functioning is essential. With the aim of gathering, disseminating, and advancing knowledge about water at the micro and nanostructure level, as well as its developments in the different areas of research, the International Panel on Water Structure – IPWS was created during the World Water Forum of Brasília, in 2018. Just as the Toronto Conference in 1986 was a milestone for the climate agenda to spark a process of organization, by the scientific community, of what became the Intergovernmental Panel on Climate Change – IPCC, the 8th World Water Forum held in Brasilia in 2018 became a milestone in the agenda of the micro and nanostructure of water.

The IPWS connects leading researchers who develop research on water structure and related fields of knowledge and their most diverse applications from an interdisciplinary perspective. IPWS gathers and systematizes the knowledge produced by independent high-level scientists, organizations, and governments. It also gives visibility and public understanding of the theme and its numerous practical applications.

The IPWS was launched in 2018 during the Water World Forum in Brasilia; now, in this next edition of the Forum in Dakar, in March 2022, significant advances have taken place. In addition to implementing the Protocol of Intent signed between several institutions and researchers to advance the Panel, 04 IPWS Partner Meetings were held between 2018 and 2021. Research on the use of magnetized water for agriculture within the scope of the project was also stimulated through CITinova, funded by the Global Environmental Facility (GEF), as well as financing a broad survey of research, researchers, and lines of research on the topic of structured water in Brazil and worldwide. Another strategic partnership established was with WATER – A MULTIDISCIPLINARY RESEARCH JOURNAL, directed by Prof. Gerald Pollack of the University of Washington. Dr. Pollack and the WATER JOURNAL team have accepted an invitation from IPWS to run a special edition of the journal for the Dakar World Water Forum, which we launched today.

The network of IPWS supporters and researchers gradually expands, as does this critical knowledge about water. In this World Water Forum in Dakar, a new

step is taken, with the signing of the Addendum to the Memorandum of Understanding signed in 2018 and new partners' entry to strengthen the initiative. We are very honored to have partnered with the journal, WATER – A MULTIDISCIPLINARY RESEARCH JOURNAL, and look forward to continuing together in the joint exploration of this fascinating world of water.

### **Sergio Augusto Ribeiro, MSc**

*Director-General, CIRAT – International Centre on Water and Transdisciplinarity*

*Vice President Water and Heritage ISC – ICOMOS (Latin America and the Caribbean)*

*Executive Secretariat IPWS – International Panel on Water Structure*

# Water as a Metaphor for a Transdisciplinary Approach

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Water is a transdisciplinary element in itself. It interconnects, unites, separates, adapts and is present in nature in different states, forms, and organisms. The multifaceted nature of water equally challenges researchers, practitioners, and users in finding a unity of knowledge that is crucial to (re)establishing a healthier and more sustainable way of life on Earth. This unity of knowledge and perspectives creates a kaleidoscope for the holistic understanding of water as an element – its structure, dynamics, functionality, and governance. Based on ternary logic – which recognizes the *included middle* as a universe of possibilities and synergies – the complex nature of water can only be grasped within an open system. Using this logic, stakeholders interact with uncertainties while respecting and valuing diversity, differences, and academic and non-academic knowledge. Through this logic, transdisciplinarity opens the way to alternative ways of perceiving, thinking, understanding, being and behaving in a world that is submerged in poverty, inequality, and climatic and sanitary crises. At the same time, the potential of transdisciplinary approaches to efficiently address the world's most pressing issues still requires improvement and legitimation. A transdisciplinary approach addresses the socio-environmental dimension of water governance and can be a source of optimism and opportunities for collaboration. Water governance is, in this regard, committed to valuation of ecological and cultural diversity; to the health of people and ecosystems; and to sustainability. In this opinion article, water is presented as a metaphor of how the transdisciplinary approach – going way beyond modern science's conventional fragmentation – can offer significant governance alternatives, with positive repercussions in various fields of knowledge, and action.

# The Quantum Nature of Biological Intelligence

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Keywords: Quantum Field Theory; Raman Spectroscopy; Biological Intelligence; Nambu Goldstone Bosons; Quantum Coherence.

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Living organisms can be considered open systems, operating far from thermodynamic equilibrium – and creating, storing, and exchanging energy, matter, and information with the environment. Overall, through these capabilities, living organisms pursue continuous self-adaptation to environmental changes, which is the expression of Biological Intelligence (BI). This paper argues that self-adaptation, and, in general, BI, is based on symmetry breaking (SB) phenomena that are well explained by an extension of the principles of quantum field theory/quantum electrodynamics (QFT/QED) and Gauge frameworks. SBs would be responsible for the emergence of multi-level coherence in living organisms, in terms of balanced competition between Gauge and Nambu Goldstone (NG) bosons. This balanced competition of bosonic fields, across all organisms, would allow the coupling with the environment up to the quantum level. Leveraging on the fact that more than 70% of the body is made up of water, the paper proposes a practical method, based on Raman spectra measures in water, for detecting NG boson condensations responsible for ordering information, coherence, and memory storage in living matter.

# Water in Health, Disease and Power Generation: From Literature to Hypotheses

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Keywords: Curative Properties of Water; Power Generation; Quantum Electrodynamics.

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Water not only plays a very important role in sustaining our lives through routine matters like drinking, cooking, washing, bathing, agricultural work, etc, but, when properly treated, may also play the role of healer or curative agent, though this is not explainable by conventional science. Electrical power can also be generated from water. This paper searches for the properties behind these aspects of water. The putative curative power of water seems to be manifested through its allotrope-like (allotrope means "different physical forms having the same chemical composition") forms left induced by solutes in aqueous dilutions followed by succussion. Quantum Electrodynamics (QED) is adopted here as a tool for explaining these puzzling phenomena. In the process, an amazing specialty of water – electric power generation from it, seemingly with great technological promise - is also explained. Experimental investigations conducted by a number of researchers support the outcomes. This article will be relevant to medicine, biology, and electric power generation.

# Water as a Microdispersed System. Water “Activation” Mechanism. Water Phases at Room Conditions

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Keywords: Water Under Optical Microscope; Water “Activation” Mechanism; Water Phases at Room Conditions.

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The review provides evidence that water of any degree of purification is a microdispersed system. The dispersed phase (DP) of liquid water is represented by hydrophilic particles (mainly NaCl microcrystals) covered with a liquid crystalline hydration shell. The size of DP particles, visible through an optical microscope, is a few microns. DP is prone to aggregation and forms large associates (tens to hundreds of microns in diameter) floating in continual bulk water. Water activation by any kind of physical impact is accompanied by the disaggregation of associates and an increase in the total area of the interphase surface. This naturally changes a number of physicochemical parameters of the system (pH, Redox Potential, viscosity, electrical conductivity). The effect was described many times in the literature but had no scientific explanation within the framework of the classical theory of water structurization at the molecular level. From this point of view, the method of manual stirring of different hydrophilic surfaces with water is also considered. Based on the portrait similarity of the physicochemical properties of structured near-wall water with polywater described by Lippincott *et al* in 1969, the authors believe that under room conditions there are only two phases of water - continuous and polywater.

# Homeopathic Drugs Modify Water Structure in Ethanol Water Solution in Their Extreme Dilutions as Revealed by Electronic and Vibrational Spectroscopy

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Keywords: High Dilutions; Hydrogen Bonding Strength; Free Water Molecules; Electronic Spectra; Vibrational Spectra.

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High dilutions (HD) of drugs used in homeopathy are too dilute to contain original drug molecules. Clinical and experimental evidence shows, however, that the HDs produce specific biological effects. Water structures in HDs are thought to be responsible for those effects. In our earlier experimental studies, we defined the water structure in terms of free water molecules (FWM) and the hydrogen bond strength (HBS) of the water hydroxyl in the aqueous ethanol solvent medium of HDs. The objective of this preliminary study is to further confirm the components of water structure by electronic (ES) and vibrational spectroscopy (VS). HDs, prepared by serial dilution of a drug followed by succussion, are called potencies. Three common homeopathic drugs, *Bryonia alba*, *Rhus toxicodendron* and *Thuja occidentalis*, and three potencies of each drug were analyzed by ES and VS using appropriate statistics. The results show that the potencies tested differ from each other with respect to FWM and HBS of the water hydroxyl. We conclude that the drugs could modify the water structure in an EtOH water solution, and this modification would continue to exist in HDs beyond the Avogadro number. Original drug molecules influence the HBS in the HDs.

# Structure Formation and Physicochemical Properties of Diluted Aqueous Solutions Prepared by the Supramolecular Technique (SMT) Method

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The purpose and objectives of this article are to study structure formation and the physicochemical properties of an aqueous material solution (SM) prepared using the supramolecular technique (SMT) method. The paper introduces the study of self-organization and physicochemical properties of the initial SM and solvents: distilled water (DW), municipal water (MW) used for the SM preparation, Kazan municipal water (KMW), and samples SM/DW, SM/MW, SM/KMW. The obtained data is evidence that, in the 1:200 – 1:400 dilution interval, all the samples (SM/DW, SM/MW, SM/KMW) represented self-organized dispersed systems. They have the pronounced ability for nonlinear changes of physicochemical properties (specific conductivity, pH, and redox potential), prompting suggestions that, in this dilution interval, systems might influence biological objects within a minimum of two months after preparation of SM.

# Non-monotonous Impedance Patterns of Diclofenac Centesimal Potentiated Solutions and Their Evolution

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The impedance of heavily diluted diclofenac centesimal potentiated solutions in the range of 20 Hz – 10 MHz was studied. Each dilution was accompanied by vigorous shaking. The whole set of samples consisted of 33 iteration steps. Two parallel sets were prepared. There was no permittivity increment in the samples, which indicates the absence of mesoparticles with high dipole moment. At the same time, the resistance of the samples presented a non-monotonic character, including ultra-high dilution samples, in which the concept of diclofenac concentration does not make sense. The pattern of both sets of samples turned out to be well correlated. The evolution of the resistivity patterns consisted of a decrease of the average value with a significant preservation of the shape of the pattern up to 30 days. This means that the result does not depend on the concentration of the solute, but on the sample preparation procedure. A hypothetical explanation of the observed effects consists in the appearance of reactive oxygen and nitrogen forms during mechanical perturbation of solution and the products of subsequent complex chemical reactions.



# Non-destructive and Non-invasive Methods in Research on the Effects of Water and Ultra-high Dilution Preparations on Plants: An Overview

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This article reviews part of the history of ultra-high dilution (UHD) research or homeopathy applied to plants and water. The scientific relationship between European and Brazilian groups has resulted in solid research, producing evidence that had not previously been proposed. Amidst this evolution, new technologies have emerged, and some are discussed here. This review emphasizes diagnostic experiments using low-power laser and cold plasma generated images. Both technologies are methods discussed to assess seed germination and identify beneficial effects of UHDs in plants and water.

# Effects of Highly Diluted Substances on Aquatic Animals: A Review

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Keywords: Homeopathy; Solvatochromic dyes; Fish; bivalve; Crustacean; Amphibian.

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Recent studies on the use of highly diluted substances to treat aquatic animals have been raised in literature. These studies are mainly focused on experimental tools to elucidate the mechanisms of high dilutions' actions on living beings, and that reveal the potential use of these products as a clean and cheap technology to improve animal health. Endler and colleagues carried out the most reproducible experimental model in this field more than 20 years ago – that is, the effects of highly diluted thyroxine on tadpole development, whose papers were published between 1994 and 2015. More recently, certain species of aquatic animals – such as zebrafish and microcrustaceans – have been used as experimental models to evaluate toxicity and bioresilience. Concerning microcrustaceans, a series of studies using *Artemia salina* have shown interesting results in inducing adaptative processes to hazardous substances. At least partially, these effects seem to be associated with changes in the electric properties of water, as seen by its interaction with solvatochromic dyes.

# Interference of Water and Environmental Variables on Lead Chloride Toxicity in *Artemia salina* Model

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Keywords: ecotoxicology, microcrustacean, circalunar, water agitation, succussion.

An experimental model was established based on the premise that environmental and water conditions can influence the effects of toxic agents on living beings. To verify if circalunar phases and water agitation can modify the toxicity of lead chloride on *in vitro Artemia salina*, cysts were exposed to seawater containing 0.04% of lead chloride (equal to EC10 or 10% effective concentration) in 96-well culture plates. Thirty-six experimental repetitions were performed in four series to observe the possible effects of adding stirred water, the so-called succussed water, and of moon phases on toxicity. The cysts were recorded after 48 hours using a digital microscope (1000x magnification) to identify hatching percentage, nauplii viability and mobility. The exposure of cysts to lead chloride (PbCl<sub>2</sub>) led to an increase in the hatching rate, and this was more evident during the full moon. Addition of succussed water into the seawater medium reduced this effect to baseline levels. An increase in mobility was seen in nauplii born from exposed cysts during the full moon, but this effect was not affected by treatment with succussed water. The organization of nano and microbubbles generated after the succussion of water is supposed to be related to this protective effect. In conclusion, environmental factors, such as the circalunar cycle and products of water agitation, can modulate the adaptive control of hatching in *Artemia salina* exposed to lead chloride at EC10.

# Evaluation of the Germination of Corn Seeds Treated and Irrigated with Magnetized Water

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Keywords: Magnetic Induction; Irrigation; Seed Germination; Seed Treatment; Corn; Structured Water.

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Corn is one of the most economically important crops in Brazil, and sowing it requires special attention to soil water availability. Magnetized water irrigation is an alternative to irrigation and seed treatment. Thus, the objective of this work was to evaluate the germination of corn seeds treated and irrigated with magnetized water. The experiment was carried out in May 2021 in a greenhouse at Fazenda Água Limpa, belonging to the University of Brasília (UnB). Corn seeds were subjected to four irrigation treatments with magnetized water, namely: magnetic induction of 0.28 T (T1), 0.229 T (T2), 0.029 T (T3) and 0 T (control). The variables evaluated were germination percentage, mean germination time, fresh seedling mass, dry seedling mass and seedling vigor. The design used was completely randomized, with five replications. Water magnetization was performed using three magnetizers, Jiangsu YLD Water Processing Equipment Co. Ltd. (T1), Structured Water Agriculture Magnetizer (T2) and Magnetizer Industrial Technologies Inc. (T3). The studied levels of magnetic induction in the irrigation water, as variables germination percentage and seedling vigor, differentiated among themselves at the level of 5%. Mean germination time, seedling fresh mass and seedling dry mass did not differ between treatments.

# Solar Concentrator-Powered Atmospheric Water Condensation System: Extracting Water from Moisture While Providing a “Clean Slate” for Beneficial Water Structuring

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Keywords: Atmospheric Water Condenser; Ammonia Absorption Refrigeration; Solar Concentrator; Water Memory; Structured Water; Water Remineralization.

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One of the most challenging effects of climate change is lack of safe drinking water in more and more areas of the world. Wells are expensive and may contain toxins or give rise to legal hurdles. Conventional atmospheric water condensers are technically feasible but cost-prohibitive because of fuel or electricity consumption. A solar collector combined with an ammonia absorption refrigeration system is a perfect match where low-grade heat energy is efficiently collected from sunlight and used to drive a cooling cycle to condense ambient humidity while providing refrigeration and room cooling. The condensate is essentially distilled water free of toxins commonly present in ground and surface sources. It is “virgin” from a structured water perspective sourced *in situ* from completely unstructured individual H<sub>2</sub>O vapor molecules and can therefore be considered nascent before any structuring has begun. Any previous “memory of water” would have been erased. This offers the unique opportunity to remineralize the water with selected beneficial mineral beds and use energizing flow patterns to revitalize it, and possibly imbue it with information if desired. While solar concentrators and absorption refrigeration are not new technologies, the innovations are efficient transfer of heat from the concentrator to the refrigerator, automation, optimal system control with an inexpensive microcontroller and the low-cost/low-tech/low-maintenance design of the system. Currently there are no such systems on the market. Non-technical personnel can be taught to build, program, and maintain an installation. Since it is self-contained and self-sufficient, it is mobile if mounted on a trailer for rapid deployment to areas of need.

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