

# Structured Water and Cancer: Orthomolecular Hydration Therapy

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**Abstract:** It is a common practice to envision cancer exclusively as a genetic disease, however, in our perspective, changes in gene expression leading to malignancy are secondary to biochemical disturbances and at its core we consider cancer as a metabolic energetic disease. In this regard, incongruence with the concept of the bioenergetic theory of carcinogenesis, we propose structured water (EZ water), as an element that facilitates the correction of the fundamental energy disruption and the reestablishment of health. The prime approach for this therapy would be to infuse kosmotropic osmolytes by the intravenous route to improve the physiological conditions and promote the reduction of cancer growth with no side effects. By doing so, we could expect that the cells will regain their communication ability with a functioning Ras and p53 proteins and other metabolic and transcription factors. The end goal is to support the cell in overcoming its low-energy anaerobic glycolytic metabolism that favors uncontrolled growth and regain the full energetic potential of oxidative phosphorylation that supports controlled cell division and differentiation. To achieve this goal, we propose the use of metabolic correction to improve the membrane function of the mitochondria. The use of precursors, enzymatic cofactors, and a variety of biological response modifiers which includes structured water and its kosmotropic properties in enzyme dynamics are part of the metabolic correction concept.

**Keywords:** Structured water, Cancer, Cellular hydration, Orthomolecular medicine.

## INTRODUCTION

Cancer is among the top causes of mortality in the world. Nevertheless, there is still no definitive cure or treatment capable of fully eradicating it. The reason for this is well tied to the origin of this disease. According to the National Cancer Institute, cancer is the process in which atypical cells keep multiplying themselves in an uncontrollable way, eventually affecting the healthy cells around them [1]. Unfortunately, current cancer treatments produce serious side effects or may not guarantee the extermination of all cancer cells in their entirety. In addition, even though most conventional cancer treatments kill cancer cells and reduce tumor size, it does not address the underlying cause of cancer. With the progression of the understanding of cancer and its metabolic implications, other forms of treatment in line with this enhanced understanding of the disease have emerged. For over a decade, studies on the mitochondria have enabled new ways of viewing cancer as a metabolic disease with implications in treatment [2-5].

When cells undergo the malignant transformation, they lose the capacity of performing oxidative

phosphorylation including both the Krebs cycle pathway and the electron transfer chain in the mitochondria, instead, they resort to anaerobic glycolysis (fermentation) as their main form of energy production [3, 4]. This process produces significantly less ATP, which redirects the metabolic process toward survival mode, which favors rapid cell growth [4]. This phenomenon is part of the new principles that suggest the Warburg effect as the main cause of cancer. Cancer originates from damage to the mitochondria that impairs the cell's capacity to generate energy with oxygen with a concurrent increase in energy generation without oxygen [5]. This theory provides a framework that supports the notion that innovative methods for studying and treating cancer can be implemented by restoring the natural metabolic state of the cell. To do this, it is important to take into consideration the physical changes that the cell expresses. For instance, the malignant transformation from normal to cancerous cells produces major physical and bioenergetic changes that favor activation of oncogenes. This oncogene activation perpetuates cell proliferation. Also, high entropy is observed at various physiological levels; molecular, macromolecular, membrane bound, organelles, tissues, organs, and systems. In addition, a high number of unbalanced protons, disorganization of the structure of water inside the cell, and other changes caused by this instability further promote an entropic state [5]. Early in the development of nuclear magnetic

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resonance, it was found that malignant tissues were characterized by an increase in the freedom of motion of tissue water molecules, a sign of disorder [6].

Exogenous Interfacial Water Stress (EIWS) is a property of interfacial water causing a tension that destabilizes enzymes, protein structure, and membranes [7]. Since metabolic energy production is dependent on enzymes as is the integrity and functionality of membranes and metabolism in general, any elements that cause EIWS will presumably disturb energy production and therefore be deleterious.

To improve energy production and mitochondria functionality, metabolic precursors, enzyme cofactors, and other biological response modifiers have been used. Moreover, specific lipids have been used to support the repair process of the mitochondrial membrane [8, 9]. Changes in the availability and type of energy in the cell in addition to producing metabolic alterations; are capable of producing changes in the intermediary messaging to the nucleus that may activate oncogenes. Because transcription and translation of DNA into proteins are dependent upon the timing of genetic unfolding and this process can be altered by the properties of water [10], and even the proper folding and function of the proteins can be affected by the properties of water [11-13], the effect of structured water on oncogenesis should be further investigated. Furthermore, a series of in-vitro studies showed that the structured water prepared through a mixture with the hydrophilic ceramic powder exhibits antioxidant properties [14]. Also, structured water demonstrated significant improvement in the viability of macrophages, in addition, it appears to suppress the viability of MCF-7 cancer cells [14].

### **STRUCTURED WATER (EZ WATER CONCENTRATION)**

Structured water (magnetized, hydrogen, or hexagonal water) refers to water with a structure that has been altered to form a hexagonal cluster. Because of its distinctive properties that differ from liquid, solid, and vapor, Structured water has been referred to as the fourth phase of water, behaving like a liquid crystal [15]. Structured water at the interface of a hydrophilic thin film forms an exclusion zone (EZ), which has a higher density than ordinary water. Since its density is higher than ordinary water, microspheres in a suspension are excluded as the water is structured, and based on this phenomenon, it was named an exclusion zone [16]. Structured water can receive, store and transmit information (water memory) [17] that

is critical for life. It is the hexagonal crystalline form of structured water that enables nutrients to transmit or communicate with each other in pathways of cellular regulation and healing [17, 18].

Structured water has abundant negatively charged hydrogen ions (Elton *et al.* 2020) [19]. The negative hydrogen helps carry oxygen into the cell. Negative-ion hydrogen is a non-caloric source of cellular energy. Structured water in cells is in a unique fractal form (electromagnetic patterns) [20], which facilitates the large quantity of information that these cells can manage. This unique cellular capacity enables a cell to amplify syntropy forces of renewal over entropy forces of decay.

### **ORDER, ORGANIZATION AND COMPARTMENTALIZATION EQUALS EFFECTIVE COMMUNICATION**

Cellular energy and order depend on proper, oxygenation, nourishment, the purity of the food and environment, homeostatic and hormetic dynamics. This includes healthy nutrition, scientific supplementation, exercise, quality sleep, and autonomic balance that includes recreation and self-monitoring, relaxation and direction for a congruent message of holistic wellbeing. Cells are electrically charged. Biological energy in the form of ATP is invested to create an action potential. The typical voltage across an animal cell membrane is -60-70 mV [21].

This means that the interior of the cell has a negative voltage relative to the exterior. However, if the cellular entropy forces increase due to poor diet, water quality, lifestyle choices, and unhealthy lifestyles; then cellular charge (voltage) will fall towards positive (+mV): the state of disease. The structured water in the cells may act as a fractal antenna to enable complex communications between cells. Also, structured water molecules surrounding the genetic material of DNA can influence gene expression, along with DNA stability and the cohesion of its electromagnetic field (Montagnier *et al.* 2015) [18]. In structured water, there is a water separation into two different substances or phases [22]. Interaction of these phases has very different properties, which are closely related to the special properties of water in living matter: in particular, in the cell protoplasm. Water in living cells, filled with proteins, polysaccharides, and nucleic acids, is structured due to the interaction with all these molecules and so differs in its properties from "normal" water [22]. The different states of water in the cellular and extra-cellular phases prevent these two phases from mixing (Phase Theory of Protoplasm) [23].

Interestingly, ordered water molecules connecting key residues and structural elements of the electron transport system have been found in the mitochondria [24].

To study the role of intracellular water during the transition from normal to malignant state, differences in the dynamic activity of intracellular water were measured. Prostate and breast carcinomas and osteosarcoma were studied using the technique of quasi-elastic neutron scattering. It was found that cytoplasmic water (particularly the rotational motions) undergoes significant changes upon a normal-to-cancer transition and demonstrated clear differences in the elastic intensity [25]. The elastic intensity provides a measure of the amount of immobilized water [26].

### **THE ROLE OF STRUCTURED WATER IN METABOLIC ALTERATIONS**

Recent studies using infrared photodissociation (IRPD) spectroscopy have shown that ions promote structural order to water molecules. A sulfate ion can order 36-46 molecules of water, which is estimated to be equivalent to three hydration layers [27].

Based on the work of Hofmeister in 1888 with the effects of salts and the precipitation of proteins and later works, ions have been classified as kosmotropes or chaotropes based on their ability to organize or disorganize structures [28]. Ions with high charge and polarizability are more likely kosmotropes and promote order. Ions with a lower charge and high polarizability tend to be chaotropes [29].

The decrease in the cytoplasmic kosmotropic osmolytes gradually transforms the structured water into unstructured water, which eventually causes a reduction in the order-information degree of the cellular thermodynamic-energy system, which upon reaching the maximum tolerable entropy, causes the cell a "near-death state".

This unbalanced, entropic activity forces the cell into a survival mode that favors uncontrolled cell proliferation. Highly stress, unbalanced cells put into action millenarian mechanisms of survival, such as fast cell division without differentiation, which precisely kept normal cells alive on the planet during Evolution. In this way, cells first discard the heavy, complex mechanism of oxidative phosphorylation and begin to operate in the archaic cycle of Embden-Meyerhof (anaerobic glycolysis), which provides the necessary ATP's for the nucleus cell cycle proliferative genes, activate signaling

factors, and pathways, and promote cytoplasmic alkalization, etc. All these elements together promote neoplastic cell proliferation, decrease apoptosis, promotes the formation of new vessels and impede cell differentiation. Measures that transform unstructured water into structured water, such as peritumoral hyperosmolality and increased intracellular kosmotropic osmolytes, and strategies that increase mitochondrial oxidative phosphorylation may restore physiological and cellular bioenergetics. The restoration of these metabolic parameters will provide the necessary information to reestablish order, organization, and compartmentalization that can stop neoplastic cells proliferation, promote differentiation, and restore cellular metabolic harmony [5, 30].

Essentially, many of the initial alterations in the cell are the product of the decline in structured water. Non cancerous cells contain a high amount of structured water, also known as Exclusion Zone water (EZ water), which works as a solute in the extracellular matrix and can store electrical energy within the cell [15]. Furthermore, it also has the capacity to stabilize and protect DNA and RNA molecules, and the mitochondria. As a result, a lack of EZ water decreases kosmotropic osmolytes. The primary role of these kosmotropic osmolytes is to maintain the integrity of cells.

Unstructured water may increase entropy levels and promote the activation of oncogenes that cause the cytoplasm to turn alkaline [30]. All factors that decrease the production of ATP favor the increase of metabolic entropy and decreases the degree of order-information of the open thermodynamic-energy system. This metabolic informational disturbance is the main cause of the disease state [5]. Most neoplastic cells work with energy from anaerobic glycolysis, which generates large amounts of lactic acid and acidifies the intracellular environment.

Research efforts have suggested that the promotion of hyperosmolarity can be used as a form of treatment. Hyperosmolarity increases EZ water inside the cell, which in turn promotes apoptosis. This approach has a minimal effect on neighboring healthy cells, suggesting this treatment as a possible option for cancer [30]. This treatment would function by restoring the structured water with the appropriate levels of EZ zones back into the cell. By doing so, the cell returns to its normal state of order and organization, which enables the cell to continue its normal metabolic course which includes reestablishing apoptosis. Restoring the cell's metabolic

fate substitutes the invasive and major damage of conventional treatments like chemotherapy and radiotherapy. An interesting correlation between the decrease in tumor growth, infection levels in the lymph nodes, and the restoration of EZ water via kosmotropic osmolytes by intravenous cycle has been reported [30]. Vitamin C when given intravenously at high doses is hyperosmolar, therefore it may have a direct kosmotropic effect. In addition, it has been shown that vitamin c catalyzes the conversion of a variety of biomolecules to synthesize and transport sulfate ions, which have important kosmotropic properties [31, 32].

The analysis of cancer through the bioenergetic theory of carcinogenesis establishes that the restoration of exclusion zone water can help reestablish the apoptosis mechanism within the cell [4]. This therapeutic proposal does not intend to cure cancer in its entirety on its own or propose a total eradication of treatments that involve chemotherapy or radiotherapy. Contrarily, the analysis of the use of structured water and its therapeutic implication should be further investigated as an adjuvant or alternative where past treatments have failed to reduce or eradicate cancer cells significantly. Further research must be executed to determine the extent of efficacy of EZ water treatments in cancer, depending on the cancer stage that is being studied. A system in disorder state (entropy) can pass into a state of order (enthalpy) if it is subjected to a considerable flow of energy [5, 33]. An open system when subject to a great flow of energy increases its degree of order-information. Life is an eternal struggle to maintain order and energy. Energy without order and order without energy are incompatible with life [30].

## CONCLUSION

In conclusion, structured water may serve as an adjuvant therapeutic tool that helps facilitate the restoration of normal metabolic parameters of the malignant cells that may induce cellular redifferentiation. Structured water synergistic action with other orthomolecular therapies may in general improve cancer patient outcome.

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