Water as a Pulsatile Proton Waveguide: Collective Oscillations, Heparan-Sulfate Lattices, and Mast-Cell-Mediated Biofield Dynamics

A contribution to the Biofield Research Group following Dr. Caitlin Connor's presentation on "Anomalous Changes in Water pH and PPM Produced by Naïve Energy Practitioners" (16 April 2026).

Thank you, Dr. Connor, for your careful, long-term research into how intentional energy practices can produce measurable shifts in water pH and parts-per-million (PPM) properties, both in isolated systems and, most importantly, inside the living human body. Your work speaks directly to a central question in biofield science: how subtle influences translate into changes in the body's primary medium, water, and thereby affect health and disease. The reminder from a study group member to think about ions was especially helpful, for ions serve as the charge carriers that ride the very protonic and dielectric waves described below.

Water as an Active, Collective Oscillator

The adult human body is approximately 60 percent water by weight. The interstitium, the fluid-filled spaces surrounding cells, contains the majority of extracellular water and is itself highly hydrated. Liquid water is far more than a passive solvent. Its molecules form a dynamic hydrogen-bond network that behaves as a system of coupled oscillators. The key parameter governing this collective behavior is the dielectric relaxation time τ (pronounced "tau," approximately 8 picoseconds in bulk water at room temperature). τ measures the lag between an applied oscillating field (or local bioelectric perturbation) and the network's polarization response. When τ shortens, due to changes in temperature, local charge density, pH microdomains, or structuring by biomolecules, the transient phase mismatch between the driving force and the oscillators' response narrows. The network restabilizes more rapidly. In the language of synchronization dynamics, this pushes the system closer to a critical threshold where collective behavior emerges abruptly rather than gradually.

This critical threshold is described by the Kuramoto model of coupled phase oscillators (Dörfler & Bullo, 2011). In simple terms, the model shows that when the coupling strength K among oscillators exceeds the spread in their natural frequencies ($\Delta\omega$), the system undergoes a saddle-node bifurcation: a sudden transition from disordered, independent motion to partial or full synchronization. The result is coherent, wave-like events rather than continuous low-level fluctuations. Recent experimental and simulation work has shown that large angular reorientations in water (greater than 60 degrees) occur through precisely such collective defect waves involving dozens to hundreds of molecules on picosecond timescales (Offei-Danso et al., 2023). These bursts accelerate Grotthuss-style proton hopping along hydrogen-bonded “proton wires,” converting ordinary diffusion into fast, coordinated charge transport (Selberg et al., 2019).

Importantly, not all water in the body is equivalent. Water structured around heparan sulfate exhibits distinct collective oscillatory properties, higher proton conductivity, and supports elevated local concentrations of growth factors and morphogenetic signals compared with bulk water. These structured-water effects further illustrate that a smaller τ does not weaken the underlying coupling. Instead, it sharpens the pulsatile character of the response. The transient mismatch cannot persist; the network rapidly restabilizes, firing clean, synchronized pulses.

Mast Cells and the Interstitial Heparan-Sulfate Lattice: Nature’s Proton Waveguide

Connective-tissue mast cells, particularly those of embryonic yolk-sac erythro-myeloid progenitor (EMP) origin, play a unique role in harnessing these water dynamics (Gentek et al., 2018; Li et al., 2018). These cells seed tissues between embryonic days E8.25 and E10.5 and persist lifelong in adult skin, adipose tissue, dura mater, peritoneum, and perivascular niches. They retain an embryonic “fossil” frequency distribution, an epigenetically preserved memory of early developmental oscillatory frequencies (Ca^{2+}, ROS, and redox cycles) that was fixed *in utero*. This epigenetically preserved memory is not inherently pathological; it provides the exquisite sensitivity that supports both normal homeostasis and adaptive responses, though it can confer vulnerability under certain perturbations. This gives adult mast cells of embryonic lineage an extraordinary sensitivity to subtle environmental gradients.

Their surface and granule proteoglycans are dominated by highly sulfated heparan sulfate (HS) chains synthesized via the NDST-2 isoform and anchored on the serglycin core protein. Heparan sulfate (HS) molecules are long, negatively charged linear polysaccharides belonging to the glycosaminoglycan family. They attach to core proteins (proteoglycans) and are found on cell surfaces, in the extracellular matrix throughout the body, and stored inside mast-cell granules. These HS domains are strongly hydrophilic. In the interstitium, HS chains organize surrounding water into extended, proton-conducting hydrogels. During fetal development, these same HS-water lattices act as morphogenetic waveguides: they establish bioelectric gradients, guide cell migration, and orchestrate tissue patterning and organ formation. The protonic currents they support help shape the very architecture of the embryo. Recent reviews further position mast cells as versatile signal converters linking tissue states to neuronal responses (Plum et al., 2024).

In the adult, the same mechanism remains active. When an embryonic-lineage mast cell crosses its Kuramoto critical threshold, whether triggered by neuropeptides (via MRGPRX2), viral proteins binding HS, or subtle biofield cues, it degranulates. The sudden release of histamine, tryptase, heparin, cytokines, and lipid mediators locally perturbs the interstitial HS lattice. This further shortens local τ. The surrounding hydrophilic HS domains become a pulsatile proton waveguide:

- Collective angular-jump bursts fire as discrete, high-amplitude pulses.
- Proton currents (accelerated Grotthuss hopping) propagate outward as crisp wave trains.
- These pulses entrain neighboring cells' own oscillators, producing tissue-scale synchronization avalanches.

Ions (the carriers emphasized by Lynn Brodlie) ride these pulsatile waves, directly linking the observed pH and PPM shifts in Dr. Connor's experiments to measurable ionic fluxes within the structured-water matrix of the interstitium.

Bridging Photons, Protons, and Ions in the Biofield

The perspective that the human body is a photon field is powerful and fully compatible with the protonic and dielectric picture above. Photons, protons, and ions interact within the same HS-structured water environment. Energy practitioners who induce anomalous pH and PPM changes are plausibly modulating precisely these protonic waveguides, altering local charge density, H-bond topology, and relaxation time τ. The resulting ionic and pH shifts are observable signatures of deeper collective oscillatory dynamics.

Implications for Health, Disease, and Biofield Research

Chronic perturbations (for example, persistent viral-protein binding to HS) can keep τ shortened, amplifying pulsatile "storms" that manifest as systemic inflammation or fibrosis. Conversely, coherent biofield interventions may restore appropriate coupling strengths and relaxation times, supporting ordered signaling and homeostasis. The embryonic origins of these mast-cell HS lattices ensure that early developmental conditions continue to influence adult physiology, linking fetal morphogenesis directly to lifelong biofield responsiveness. For striking visualizations of embryonic vasculature and nervous system mapping relevant to these morphogenetic HS-water dynamics, see the Wirtz laboratory preprint and 3D mapping shared here:

https://x.com/DianeMKane1/status/2044090685993955824.

Additional resources on HS lattices, mast cells, and bioelectric signaling are available at:

https://x.com/DianeMKane1/status/2027789610613674040 and

https://x.com/DianeMKane1/status/2025744505740443805

Glossary of Key Terms

Dielectric relaxation time (*τ, pronounced "tau"*): The characteristic time for the water hydrogen-bond network to reorient after a perturbation. Smaller τ leads to a faster, more pulsatile collective response.

Kuramoto model/saddle-node bifurcation: Mathematical framework describing how coupled oscillators suddenly synchronize when coupling strength exceeds frequency spread. The bifurcation marks the abrupt onset of coherent pulses from disorder.

Collective defect waves/angular-jump bursts: Coordinated, wave-like reorientations of dozens to hundreds of water molecules (Offei-Danso et al., 2023).

Grotthuss proton hopping: Proton conduction along hydrogen-bonded water wires, accelerated by the above bursts.

Embryonic "fossil" frequency distribution: Epigenetically preserved oscillatory profile (Ca^{2+}, ROS, redox) set in utero in yolk-sac-derived mast cells and retained lifelong.

Pulsatile proton waveguide: The interstitial HS lattice (especially NDST-2-sulfated domains) acting as a structured medium for discrete, propagating protonic/ionic pulses.

Morphogenetic signaling: Bioelectric and protonic gradients that guide embryonic tissue patterning and remain active in adult repair and inflammation.

Dr. Connor's findings provide an excellent empirical testbed for these mechanisms. Future collaboration could examine whether practitioner-induced fields preferentially affect τ or proton conductivity in HS-structured versus bulk water, or how the embryonic priming of mast cells modulates these responses.

I offer this synthesis in the spirit of open, interdisciplinary exploration that defines the Scientific and Medical Network. I welcome thoughtful dialogue and any questions from group members.

With appreciation and respect,

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