

# "REVISITING WATER MOLECULES"

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Water is commonly treated as a simple, structureless solvent whose properties are fully captured by equilibrium thermodynamics; however, decades of research increasingly show that its behavior is strongly shaped by context, history, and interaction environment. At molecular scales, water participates actively in chemical reactions, mediates biomolecular recognition through structured hydration layers and conserved water bridges, and exhibits altered dynamics near interfaces, in confinement, and in complex or crowded systems. These deviations from bulk behavior suggest that water can transiently encode information about surrounding surfaces, solutes, and processing conditions through collective hydrogen-bond networks and modified relaxation dynamics. While such effects do not imply long-term or solute-specific “memory” in the classical sense, overlooking them can create conceptual and practical hazards in fields that rely on water as a passive medium, including molecular biology, medicine, materials science, and environmental studies. This talk examines how assumptions about water’s simplicity may obscure subtle but functionally significant phenomena, and explores the boundary between well-established molecular physics and open questions concerning history-dependent behavior in aqueous systems. By critically distinguishing between demonstrable, environment-induced structuring and speculative claims, the discussion aims to clarify what forms of information water can retain, over what length and time scales, and under which physical constraints. Such an examination provides a scientifically disciplined framework within which both modern experimental observations and long-standing empirical traditions that emphasize processing, context, and interaction history can be meaningfully re-evaluated.