AQUAOMICS AND WATERONS: WATER INFORMATIONAL UNITS AT THE MEMBRANE INTERPHASE.

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The hypothesis that the thermodynamic state of water at the lipid-water interface is the dynamic constituent in membranes that may act as anthenna for biological signals to control activities of membrane-bound enzymes and to trigger cell recovery and survival in stress processes is proposed and discussed in the context of experimental and theoretical evidences.
It is based on the fact that the modulation of interfacial water activity may give specificity to the interaction of aminoacid motifs found in peptides and proteins acting as signals or effectors on cell membranes and the activation or inactivation of interfacial enzymes.
The structural organization of water at different levels of the membrane is characterized in small subnanometric hydrophobic cavities that may serve as a functional target sites of recognition for biologically relevant molecules. The deciphering of the specificity is done in terms of the hydrogen bonding network water molecules may form in the cavity. The H bonding distribution affects directly the surface free energy (globally and punctually) via changes in the local surface tension of the membrane interface. Hydration levels considered in the generation of regions with an excess of surface free energy would be responsable for triggering the response to biological effectors. It is possible that for each macroscopic state determined by temperature and osmotic state (lateral pressure) a distribution of discrete sites can be formed each one with an appropriate activity to trigger molecular processes conferring a global response.
Specific water arrangements in terms of water molecules with none, one, two, three or four H bondings in different combination with membranes groups each of them with a proper value of free energy given by a limited number of configurations that determine the water activity are identified. The great variety of lipids and the protein complexes would give the matrix for informational water units approaching lipidomics to aquaomics. That is, water arrangements that may be predetermined by cell informational machinery.

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