

Water molecules favor negative charges

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(Phys.org) —In the presence of charged substances, H₂O molecules favor associating with elements with a negative electrical charge rather than a positive electric charge. EPFL researchers have published a study on the subject that could provide new insights on the processes of cell formation.

Some say that in life, it's better to be positive... for charges immersed in water this may not be true. Researchers from the Laboratory for fundamental BioPhotonics (LBP) at EPFL have found that water molecules associate more readily with negatively charged elements when in the presence of other substances. The results of their research are published today in *Angewandte Chemie Int. Ed.*.

By using advanced optical spectroscopy techniques, scientists studied the

behavior of ions -atoms or molecules that either lost or gained an electron and which are thus electrically charged- placed in an aqueous medium. They selected two ions that were absolutely identical in terms of shape, size and chemical structure, but with opposite electrical charges. Their interactions with the electrically neutral water molecules were, however, very different depending on whether they were positively or negatively charged.

The scientists' observations showed that the [hydrogen bonds](#) -that is to say, the electrostatic force binding the hydrogen atoms with others such as oxygen or nitrogen- were more than 6 times more abundant when the ions were negatively charged. The hydrogen bonds were also much stronger. Somehow, water maintains more collaborative relationships with such [negative ions](#). Thus, they get much more hydrated and their effects, in particular on the orientation and alignment of [water molecules](#) at the interface between the two substances, were stronger and more stable.

"Our discovery sheds new light on some biological, chemical and physical phenomena", notes Sylvie Roke, who heads the LBP. "It may have an impact on many studies, for example about [cell formation](#)." According to her, it could explain why the cellular membranes have charges that are either neutral or negative. She speculates that when life emerged in the oceans 3.8 billion years ago, the first unicellular organisms opted for a more stable and more economic structure, which naturally follows from water's preference for negative charges.

More information: Scheu, R., Rankin, B. M., Chen, Y., Jena, K. C., Ben-Amotz, D. and Roke, S. (2014), "Charge Asymmetry at Aqueous Hydrophobic Interfaces and Hydration Shells." *Angew. Chem.*. [DOI: 10.1002/ange.201310266](https://doi.org/10.1002/ange.201310266)

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