

Editorial

## Water: Facts without Myths

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Among all the chemical substances available in the universe, water, with its deceptively simple formula  $H_2O$ , is the most discussed subject either in science or in philosophy [1]. If you are not convinced by this affirmation, a little experiment at no cost may help you change your mind. Just open your favorite web browser and type the word “water” in any search engine. When I have done that using Google, the number of hits was about 682,000,000 (please do not try to read all the pages). In fact, the only words that seem to beat water at this little game are “air” (770,000,000 hits with Google and 3,120,000,000 with Yahoo), and “food” (689,000,000 hits with Google and 3,820,000,000 with Yahoo). Of course this should not be a surprise, as breathing, eating, drinking just mean that you are a living entity. In fact extending the water search to “eau” (French), “wasser” (German), “agua” (Spanish, Portuguese) and “acqua” (Italian) leads to 978,900,000 hits under Google and 3,426,000,000 hits under Yahoo, showing now that water is about as important as food. After all, as everybody knows, “water is life”, and do we really have to read about one billion documents to know at least what water really is?

Of course not, as many good books and scientific reviews are available to interested readers. But, here we met a considerable difficulty, as water behavior may be studied *in vitro*, *in vivo* or *in silico*. For instance, some *in silico* scientists have suggested that liquid water was a homogenous flexible 3D-percolating H-bonded network while others preach for the existence of more or less defined water clusters in the liquid. For some *in vitro* scientists, liquid water is intrinsically a diphasic system with strong and weak H-bonded domains, while for others liquid water is beyond any doubt a single-phase system. For *in vivo* scientists, liquid water seems to behave as a two-phase system displaying low-density and high-density domains. In fact, scientists studying water in the dawn of the 21st century are facing the same dilemma as scientists studying atoms in the beginning of the 20th century. Basically, water seems to be characterized by a continuum/cluster duality as atoms display a well-known wave/particle duality. The two views are complementary and one cannot just keep one vision and

discard the other. As always, this duality is deep-rooted in our minds and not in water itself, which remains a single and unique chemical substance with amazing properties. As water properties and structure have never been discussed at the light of this possible complementary duality, it seems to be worth publishing yet another review about water. As was done for the elaboration of quantum mechanics, it is only by sticking as closely as possible to experimental facts that one may find an acceptable solution to the water puzzle. To reach this goal, it was asked to at most ten top-scientists, each an expert in a powerful physical technique of investigation, to write a contribution exposing crude experimental facts about *in vitro* or *in vivo* water behavior and the best current interpretation of these data at the light of a possible wave(continuum)/particle(cluster) duality. The challenge being tough, each scientist was selected owing to his large experience in the field of water research and to his high expertise in distinguishing between firmly established knowledge and purely mythical or intellectual constructions about water. This special issue should then be of great interest for all people interested in water properties and working in any field of science (such as physics, chemistry, biology, geology, astronomy, *etc.*) where water plays a central role.

## References

1. Henry, M. The state of water in living systems: from the liquid to the jellyfish. *Cell. Mol. Biol.* **2005**, *51*, 677-702.

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