EDITORIAL: ON GIANTS' SHOULDERS

The present issue of the journal collects several contributions coming from experts of different disciplines about water and the peculiar role it plays in ecosystems and living organisms.

Water has been recognized from a very long time to be the matrix of life. Thales [1] stressed that water was just the primeval element and this statement has been repeated many times along the centuries. As far back as in 1892 Roentgen [2] held that water should exist as a mixture of two phases, but this statement was criticized in 1933 by Bernal and Fowler [3], who observed that since water is made up of molecules obeying a well-defined Hamiltonian, there was no room for the existence of more than one phase in the same thermodynamic conditions.

This statement belongs to a reductionist point of view, according to which the properties of the ensemble are the macroscopic projection of the properties of the single molecule without any influence of possible supramolecular organization and collective properties. However, just five years later, Kapitza [4] discovered the existence of superfluid Helium, which was shown three years later by Landau [5] to be a two-phase liquid, suggesting the emergence of collective behaviours in liquids.

The presence of a collective dynamics in water, however, received increasing recognition during the years. Piccardi's pioneering work [6] has shown that water is able to change its own properties depending on the dynamics of the environment (climate, Sun and Moon activity, external electromagnetic fields and, more in general, evolution of ecosystems) showing that, since the single molecule is too tiny to receive and store complex information, a supramolecular organization should be present.

This same point of view has been adopted by Szent-Gyorgyi [7], who in the late 1950s pointed out the peculiar role of water in making possible complex biochemical processes. The role of water in promoting self-organization has been stressed by Prigogine and his school [8] in the framework of thermodynamics of irreversible processes (TIP) and furthermore by Tiezzi [9, 10]. In the last few years Pollack and his school [11] has been able to detect, attached to hydrophilic surfaces, a coherent phase of water (EZ water) and has described its peculiar properties. Very recently large fluctuations of density and molecular ordering have been reported in water in the liquid state [12], suggesting the existence of two interspersed phases. In the meantime a theoretical understanding of the collective properties of water has begun to be achieved in the frame of quantum electrodynamics (QED) [13–15]. The convergence between TIP and QED has been investigated in ref. [16].

The properties of water have been further explained by the observation of the dynamics of living organisms, mainly by Voeikov [17], who showed that water is not a mere solvent but plays an active and dynamic role in the organization and regulation of biochemical reactions. This point is also discussed in ref. [18].

All of these approaches were discussed in the brainstorming meeting held in Ischia on 24–27 May 2009, sponsored jointly by the University of Siena, the GUNA SpA Company and Dr. Adriana Carluccio. The main contributions to this meeting are collected in the present issue of the journal. There are two types of papers:

1. those related to the tradition of scientific investigations described earlier;
2. those that show peculiar and unexpected properties of water as an agent of organization of living organisms and ecosystems.

The interplay between these two types of investigation seems to be the key to progresses toward the understanding of the dynamics of self-organization in matter.

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