Preamble

We remembered that 400 years ago, on October 2, 1611 AD, Cosimo II de' Medici, Grand Duke of Tuscany and patron of the arts and sciences, sponsored a debate on the topic: Why Ice Floats on Water.

The then young Galileo led this famous debate.

Cardinal Barberini, a great admirer of Galileo the soon to become Pope Urban VIII – who eventually put him under house arrest – in a tragedy too well known to recount, was there.

We could not let the occasion pass.

So a small group of us, research scientists, took upon ourselves to organise a different kind of small meeting, in Florence, July 15-19, 2013 to commemorate the occasion.

The motivation derived too from our observation that at practically all scientific meetings these days, mutual incomprehension is almost mandatory. The focus seems always on specialised technical minutae of our disciplines, physical, colloid surface chemistry, and more. It is the same for all fields of science and technology.

The reader may be surprised to learn that the answer to the ice question is still unresolved.

So are the answers to a myriad questions about water. In the simpler terminology of an older world, our discussions would be about water, salt, air and light. And biology. And geology and, and … From that perspective we are all at sea.

It is an extraordinary and not widely recognised fact that our present, classical, theories that underpin the entire enabling disciplines of physical, colloid and surface chemistry lack predictability, from biology to earth sciences and chemical engineering. These theories are undergoing a paradigm shift from the beginnings up.

The same is true in many other disciplines like cosmology and particle physics. It is true also for molecular biology.

We wanted to have an overview debate and discussion between scientists at the cutting edge from around the world, on where we are now on WATER. And to record the situation. Hence, on **Aqua Incognita, Galileo 400 years on**.

Some technical topics that we addressed included:

1. water, its properties and structure, and in biology
2. solutions of electrolytes in water and non-aqueous solvents
3. specific ion effects in the bulk and at interfaces, particularly in medicine and biology
4. effects of light and magnetic fields on water and processes in water dispersion
5. dissolved gases, how they affect aqueous media
6. hydration and, in general, solvation and crystallisation
7. challenges to the foundations and the emerging new theories in physical chemistry

But the enquiry expanded to a more eclectic collection of papers, on Fresco restoration, on metaphysics and Galileo's problems, on chirality, on the history of water throughout civilisation, on promising advances in desalination, and deep sea water, and human sweat and touch!

Venue

The conference was held in the ancient convent "Convitto della Calza" in Florence, founded in 1362 as St. John the Baptist hospital.

The furniture for our meeting dated back 400 years, the frescos covering the walls more venerable, our visits to Galileo's house and to the Museum of the History of Science that has much of his original equipment focussed the mind.

Our debates were informal and our participants were limited to 20, with occasional attendance by wives and non specialists as for the original debates 400 years ago.

Florence itself has many attractions, being the center of the Renaissance.

So it was difficult for such a meeting to fail.

This book represents the contributions from participants and their affiliations.

Some contributions were from people unable to attend.

These and their topics follow.

Some are easily understood by laymen and non specialists, some highly technical, some very practical. Some may seem to be crazy - but nothing ventured nothing gained.

We think we achieved our aim. And hope these contributions will provide a useful perspective and introduction for anyone interested in water and its manifold manifestations.

And an insight into the science of water for the third meeting 400 years hence.

At least we are confident that Galileo would have been very pleased.

Any discussion that touches on Galileo and scientists and the Roman Catholic Church has the potential to become explosive. The Church has had a deserved very bad press for its treatment of Galileo. It has apologised for this and admits error, which is remarkable. But the regret and the stain are with us still. Many scientists remain outraged.

At first sight it is difficult to enter the mindset of western european society of 400 years ago, devastated by internal wars and attacks from the east, and dominated by a faith and dogma that to present "rational scientific minds" appear absurd.

But not much reflection is needed to remind us that we are not so rational either. Proofs of human behaviors and habits not driven by

rationality cross the centuries and pervade our current history. Wars in the name of religion at the present time are the rule rather than the exception. Philosophies and ideologies carry the heaviest burden of responsibility for the recent crimes against humanity. And sometimes science has been involved: eugenics developed in the second half of the XIX century in France, the UK, Germany, and the US as the attempt to extrapolate and apply Darwinism to humankind. The implications of science in politics, economics, and social views are significant and represent a delicate matter for our societies.

As time goes, memory needs to be preserved as a warning for the present and the future.

Sciences and faiths can honestly cooperate for the disclosure of truth and common, peaceful good for all mankind. Unprejudicially.

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