Permanent Dissipative Structures in Water: The Matrix of Life?

ROBERTO GERMANO
PROMETE SRL – CNR SPIN OFF, NAPOLI, ITALY

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Meeting in memory of Mae-Wan Ho
15-16 June, 2017
London Mathematical Society,
De Morgan House, 57-58 Russell Square,
London WC1B 4HS

Permanent Dissipative Structures in Water: The Matrix of Life?

There is now clear evidence that various kinds of low energy physical perturbations can induce the spontaneous formation of dissipative structures in liquid water.

It has recently been discovered that these structures are remarkably persistent even in the solid phase.

Using easily reproducible experimental methods, we have observed large quantities of supramolecular aggregates of water.

Are such structures the matrix of life itself?

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long-term
trust and
focus

_environment &
new technologies

_process control &
industrial automation

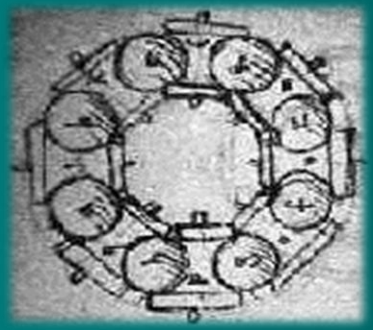
3

CORE
BUSINESS AREAS
OF GROWTH

_technology
transfer

An example of missing Technology Transfer …

1500



400 years ...

1900

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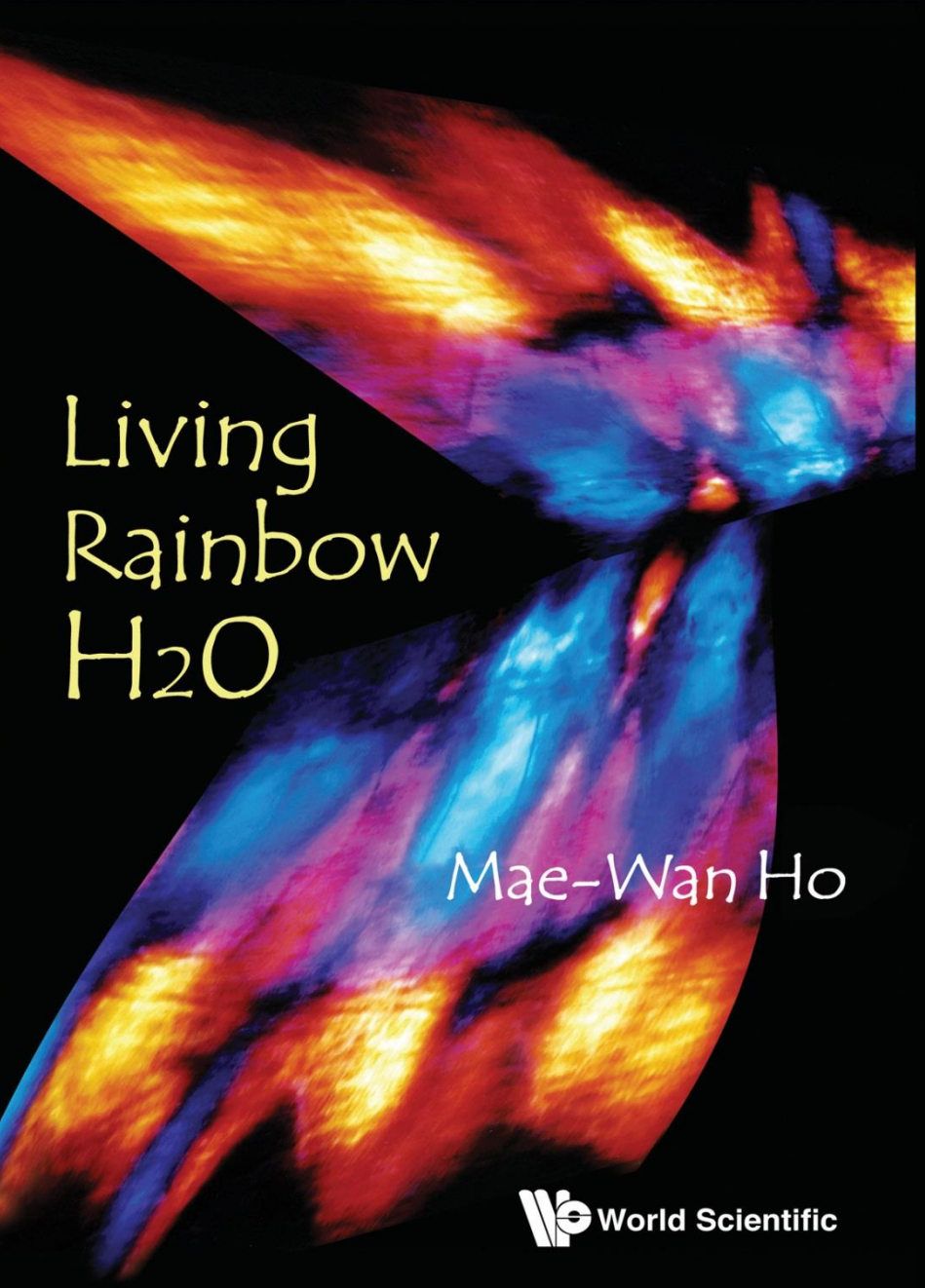

"Water is the means, medium and message of life, the rainbow within that mirrors the one in the sky"

A unique synthesis of the latest quantum physics and chemistry of water that tells you why it is so fit for life

Sequel to **The Rainbow Worm** *in the author's quest for the meaning of life*

Napoli, Nov 2011

Istituto Italiano per gli Studi Filosofici

Roberto Germano (primo a destra) e Mae-Wan Ho (terza da destra)


Le Connessioni Inattese - Intervista a Mae-Wan Ho
Condividi
AKronos


le connessioni inattese
LA FRONTIERA, L'IGNOTO, L'ERESIA


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le connessioni
LA FRONTIERA, L'IGNOTO, L'ERESIA


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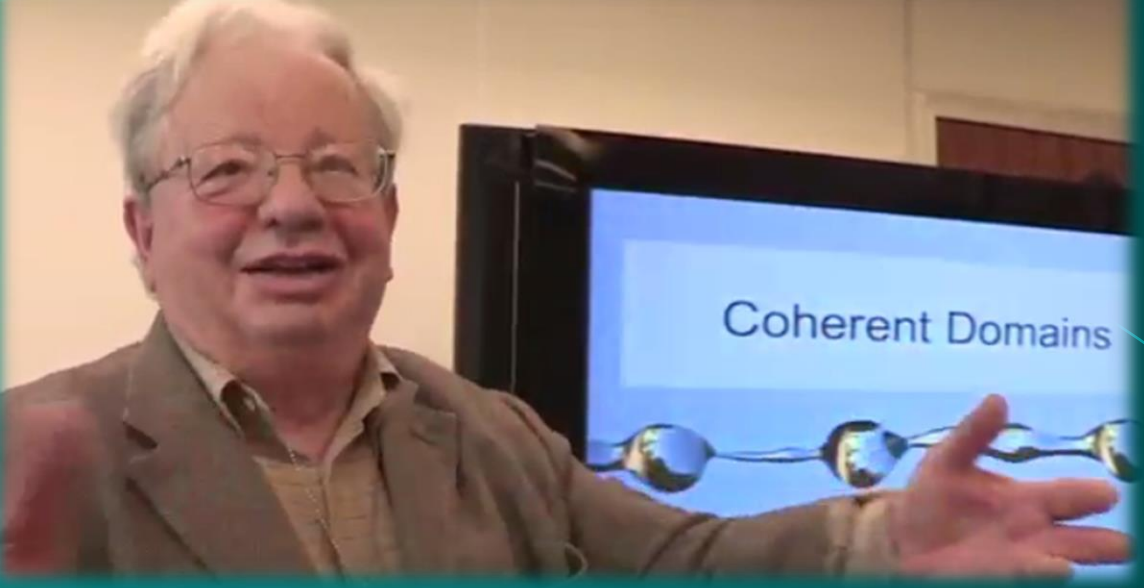
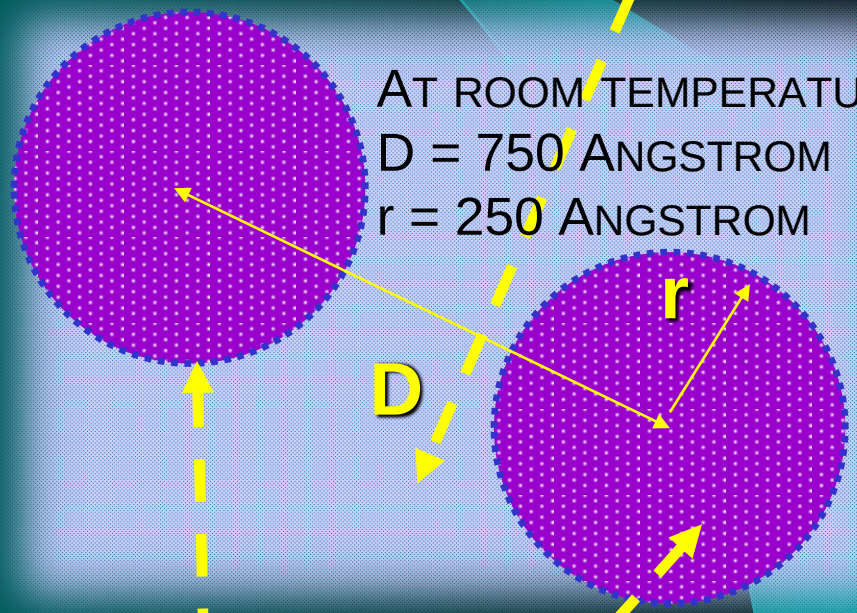


NON-COHERENT PHASE

AT ROOM TEMPERATURE
D = 750 ANGSTROM
r = 250 ANGSTROM



COHERENCE DOMAINS (CDS)

Chiral micron-sized H_2O aggregates in water: Circular dichroism of supramolecular H_2O architectures created by perturbing pure water

Vittorio Elia[a,2], Tamar A. Yinnon[b], Rosario Oliva[a], Elena Napoli[a], Roberto Germano[c], Fabrizio Bobba[d], Angela Amoresano[a]

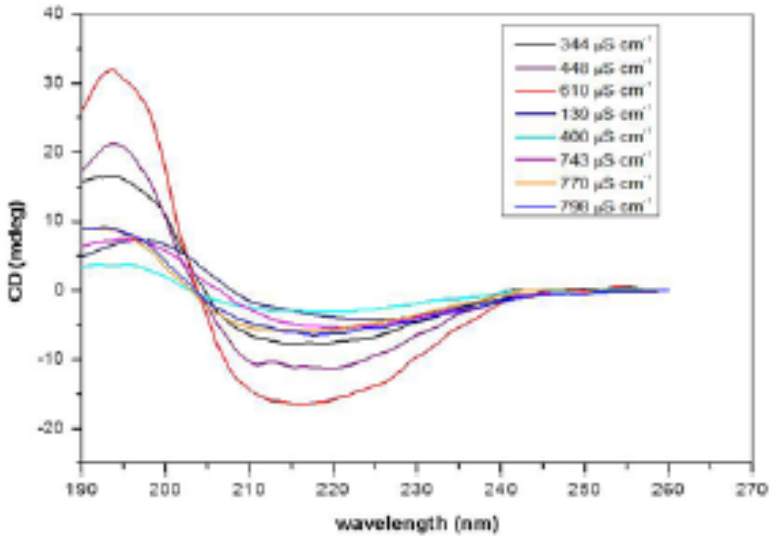


Figure 4. *CD spectra of INW samples with different electric conductivity. The CD in mdeg is plotted as a function of the wavelength in nm for samples with electric conductivity as specified in the inset. The temperature of the samples is 20 °C.*

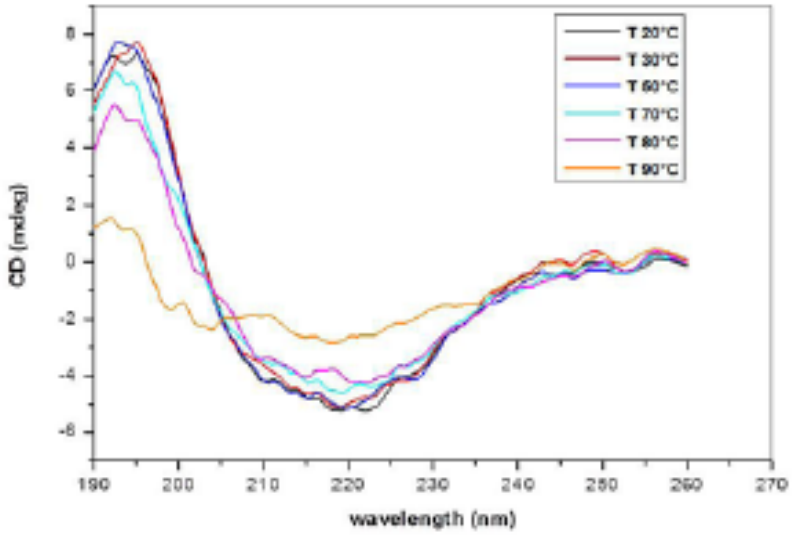
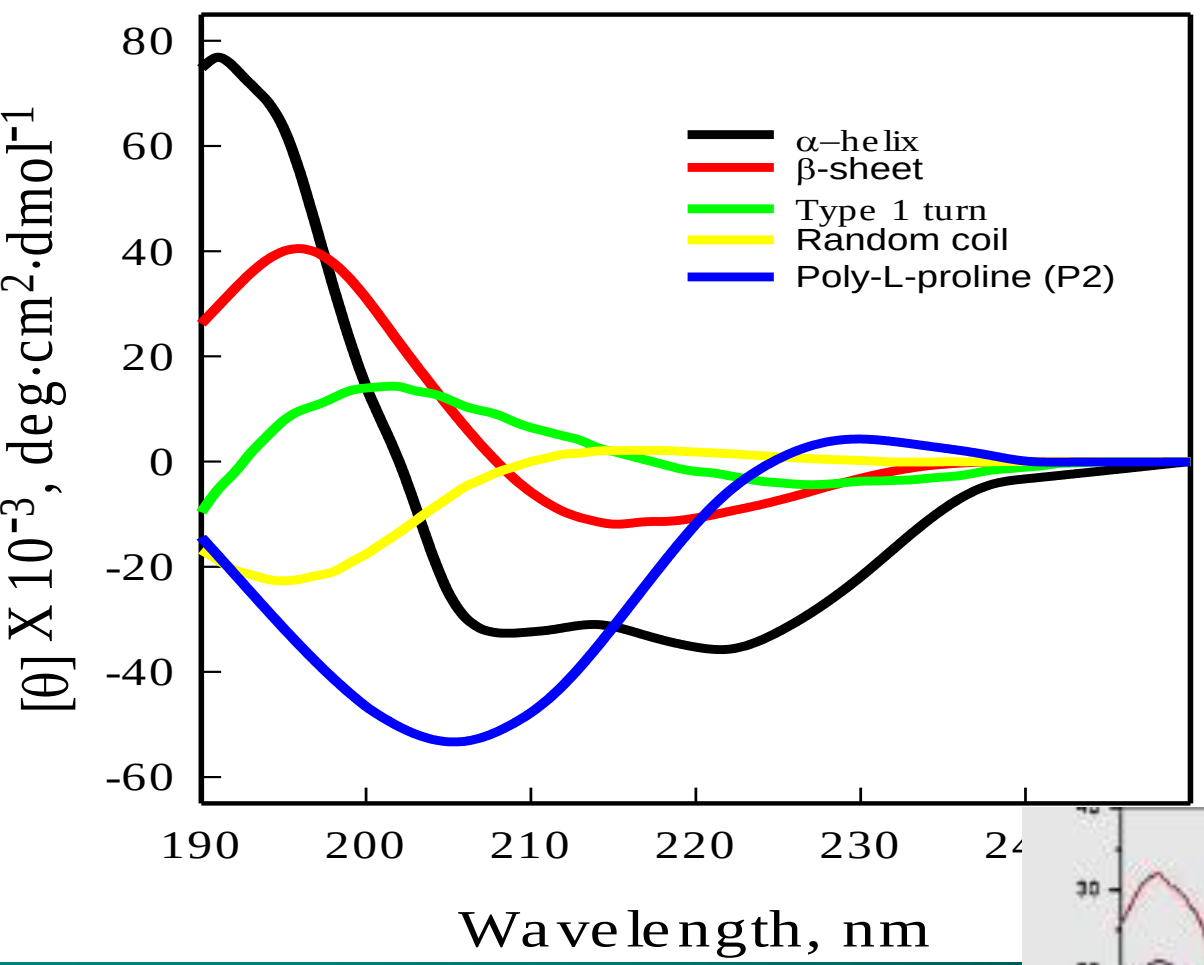
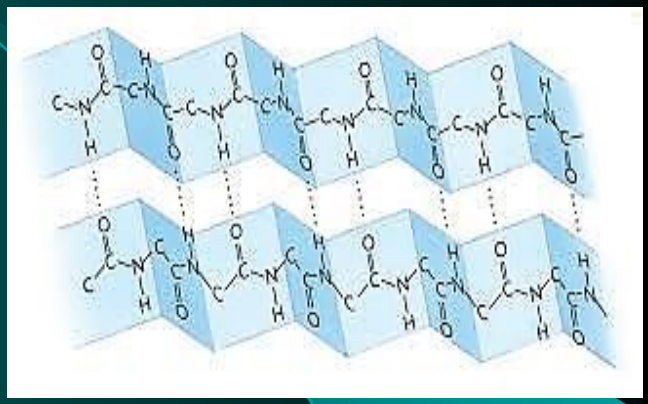
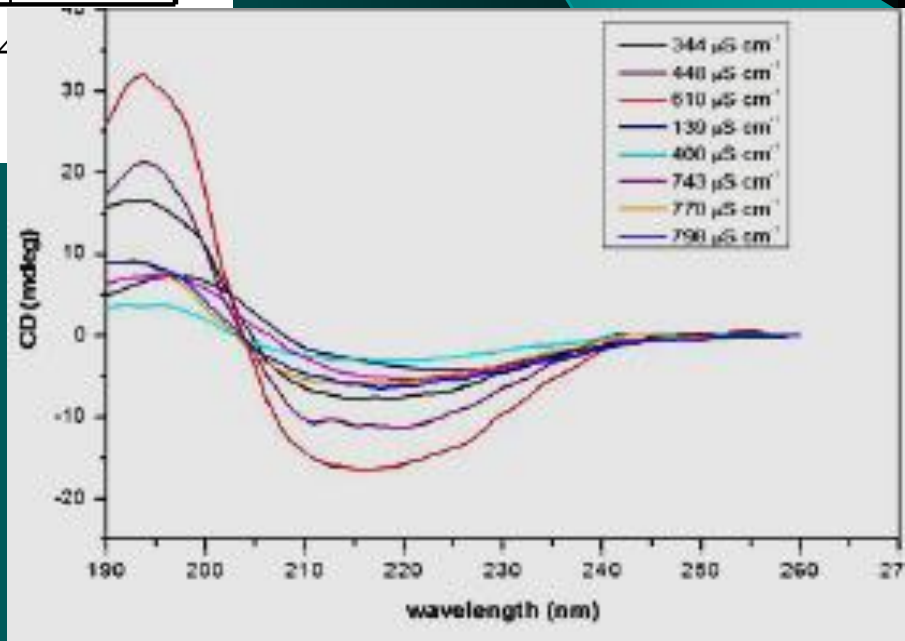


Figure 5. *CD spectra of an INW sample at different temperatures. The CD in mdeg is plotted as a function of the wavelength in nm for a sample*


80
60
40
20
0
-20
-40
-60
190
200
210
220
230
α–helix
β-sheet
Type 1 turn
Random coil
Poly-L-proline (P2)
[θ] X 10-3, deg.cm2.dmol-1
Wavelength, nm




CD (mdeg)
wavelength (nm)

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UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER

Authors

Vittorio Elia[a], Tamar A. Yinnon[b], Rosario Oliva[a], Elena Napoli[a], Roberto Germano[c], Fabrizio Bobba[d], Angela Amoresano[a]

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UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER

MICRON-SIZED SUPRAMOLECULAR H_2O AGGREGATES ARE PRODUCIBLE BY PERTURBING PURE WATER, I.E., IMMERSING A HYDROPHILIC MEMBRANE IN MILLI-Q WATER, STIRRING THE LIQUID, REMOVING AND DRYING THE MEMBRANE, AND THEN REPEATING THESE STEPS (ITERATIVELY NAFIONATED WATER).

INW SHOWS A FLUORESCENCE SPECTRA CONSISTING OF A BROAD BAND SPANNING FROM 290 TO 550 NM.

ON DILUTION OF THE SAMPLE, THE FLUORESCENCE INTENSITY DIMINISHES, AND THIS EMISSION IS ABSENT IN MILLI-Q WATER. THE ABSENCE OF ANY SHARP EMISSION PEAKS AND THE SMEARED OUT CHARACTER OF THE SPECTRA INDICATE PRESENCE OF EXCIMERS.

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UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER

TO ENSURE THAT IMPURITIES (MOLECULES RELEASED BY THE MEMBRANE, ORGANIC- OR BIO-CONTAMINANTS) DO NOT UNDERLIE AFOREMENTIONED PHENOMENA, WE EMPLOYED STATE-OF-THE-ART ANALYTIC TECHNIQUES:

MATRIX-ASSISTED LASER DESORPTION/IONIZATION TIME OF FLIGHT AND GAS CHROMATOGRAPHY BOTH COUPLED TO MASS SPECTROSCOPY, AND ION CHROMATOGRAPHY.

THE PERTURBED WATER ONLY CONTAINS 10^{-6} M FLUORINE AND SULFATE IONS RELEASED BY THE MEMBRANE AND MINUSCULE AMOUNTS OF CONTAMINANTS, BUT LYOPHILIZING THE INW PERTURBED WATER PRODUCES A PONDERAL SOLID RESIDUE!!

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PURE WATER (BIDISTILLED) →

PHYSICAL PERTURBATIONS →

→ LARGE CHANGES IN PHYSICO-CHEMICAL PARAMETERS !!!

(pH, HEAT OF MIXING, ELECTRICAL CONDUCTIVITY, VISCOSITY…)

→ ANALYSES

→ IT IS STILL …PURE WATER!!

→ **BUT …..**

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→BUT

→CIRCULAR DICHROISM: MACROMOLECULES!!!

AND

→UV FLUORESCENCE : ELECTRONIC ENERGETIC TRANSITION (280 NM)

→ $n \rightarrow \pi^*$

from a 'non-bonding' (lone-pair) n orbital to
an 'antibonding' π orbital designated as π*.

NON EXISTENT IN H_2O MOLECULES!!!!!

MOREOVER…

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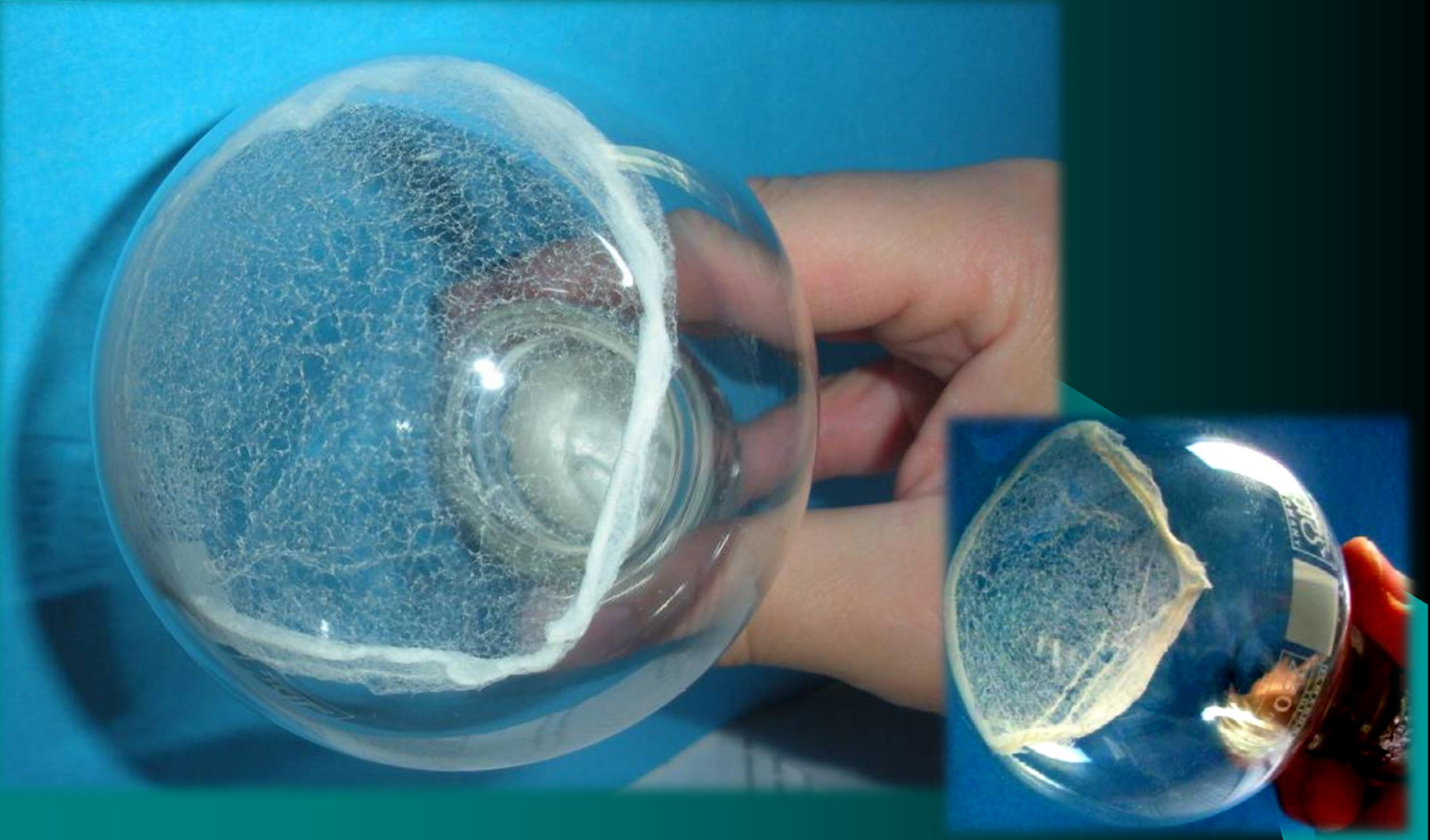
MOREOVER

IF DRYING (OR FREEZEDRYING) → A SOLID !!!!

STABLE AT AMBIENT TEMPERATURE AND PRESSURE



APPEARANCE OF THE EVIDENTLY PONDERAL SOLID RESIDUES: SOME TEN OF MILLIGRAMS COMING FROM LYOPHILIZATION OF ONLY 250 ML OF ITERATIVELY NAFIONATED WATER (IFW) → VITTORIO ELIA

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er with a Nafion membrane

I. Wash membrane in Milli-Q water.

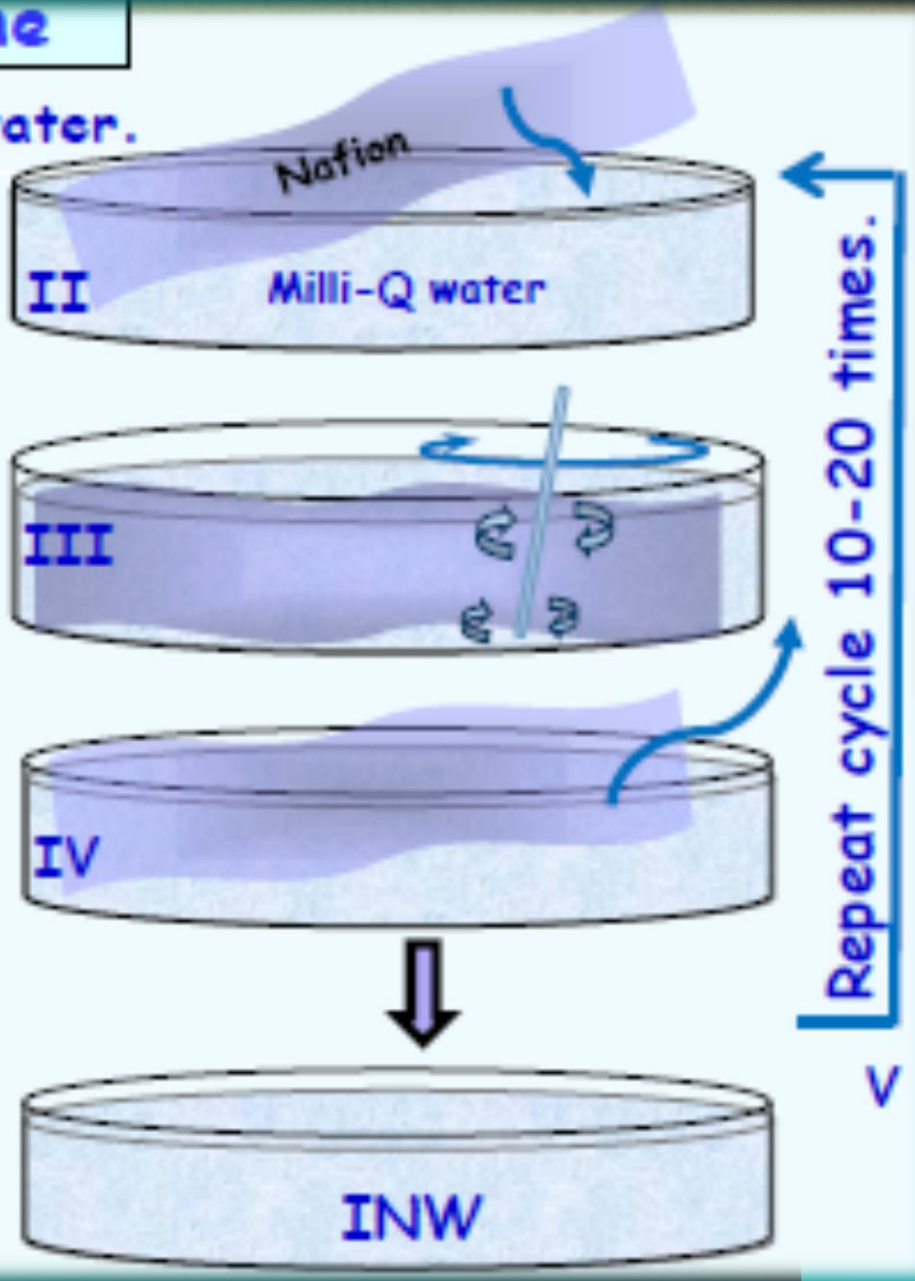
II. Immerse membrane.

III. Gently stir liquid and turn over membrane.

IV. Take out membrane and dry it in air.

V. Repeat steps II-IV 10-20 times.

Iterative Nafionized water (INW)

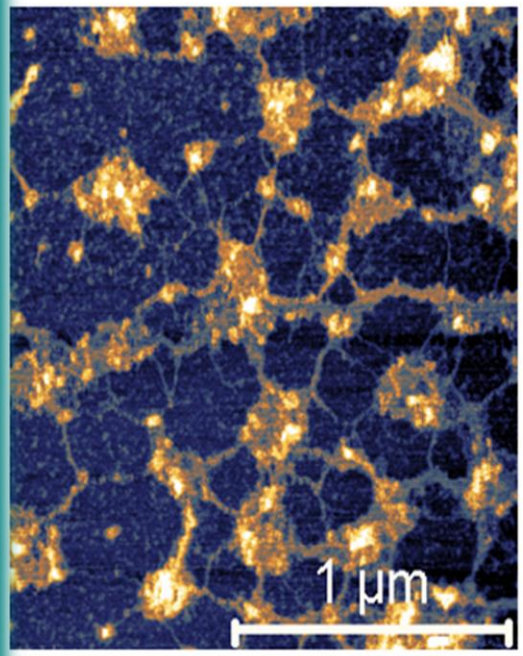


XEROSYDRYLE

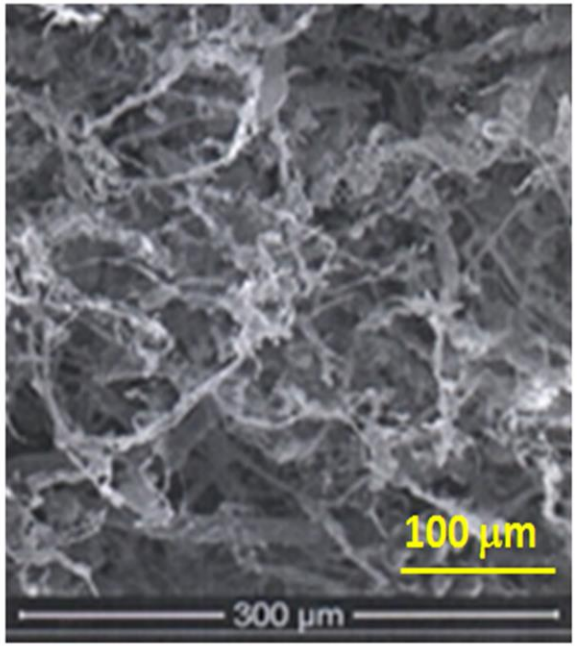
FROM ANCIENT GREEK:

XEROS (DRY) - IDRO (WATER) - YLE (MATTER)

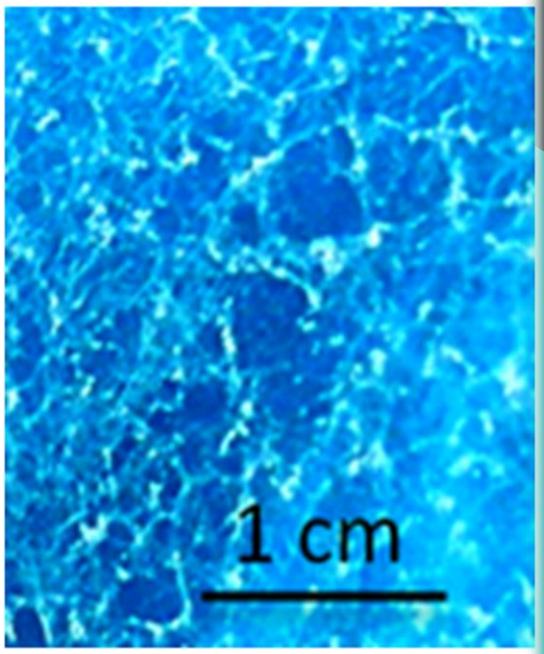
XEROSYDRYLE FRACTAL APPEARANCE



10^{-6} m



10^{-4} m



10^{-2} m

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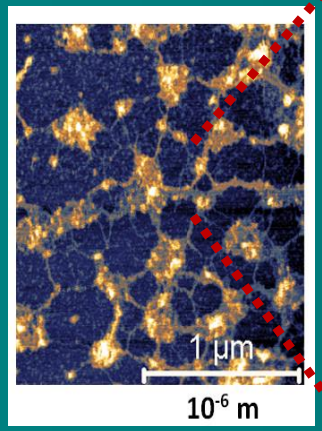
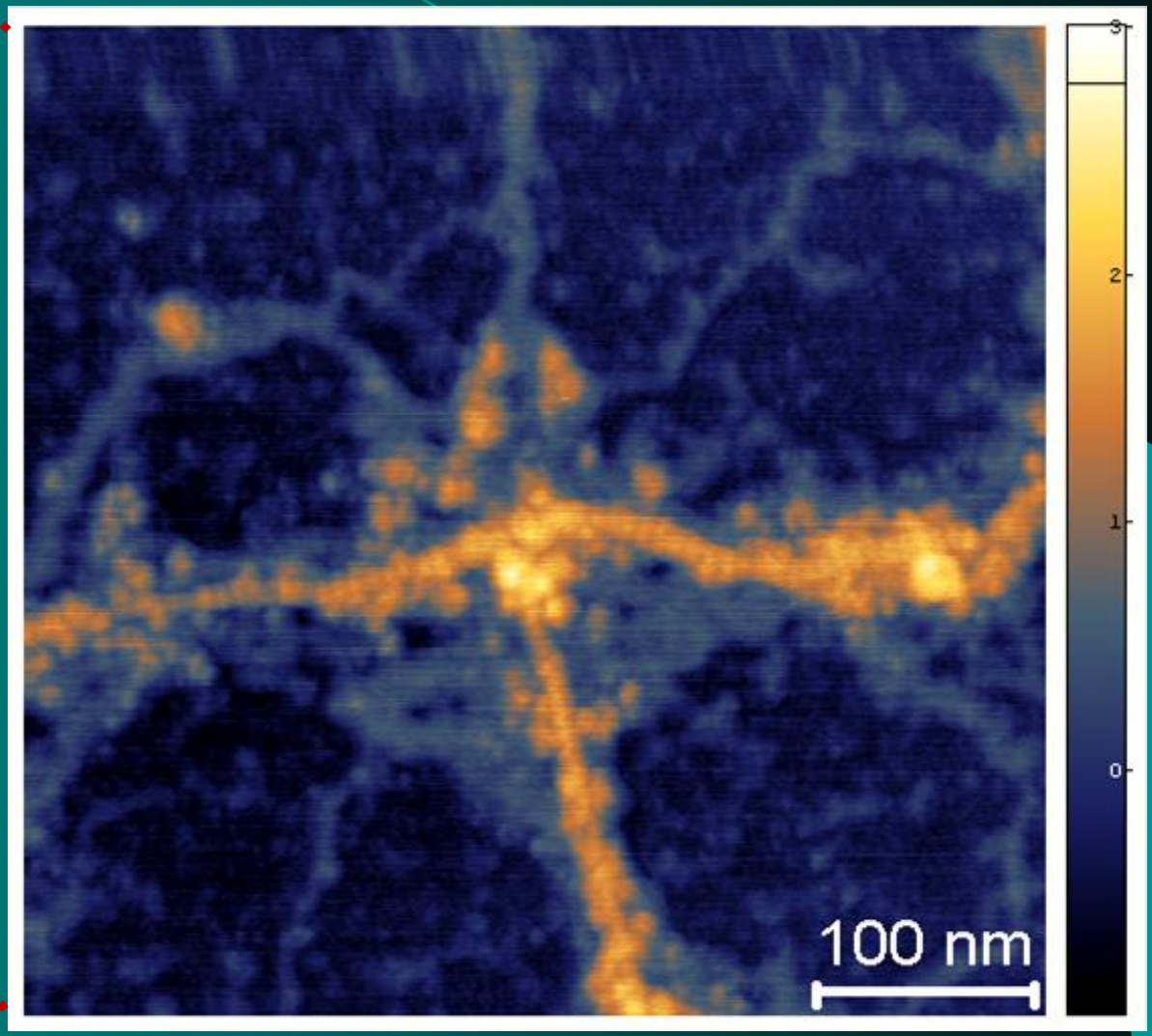
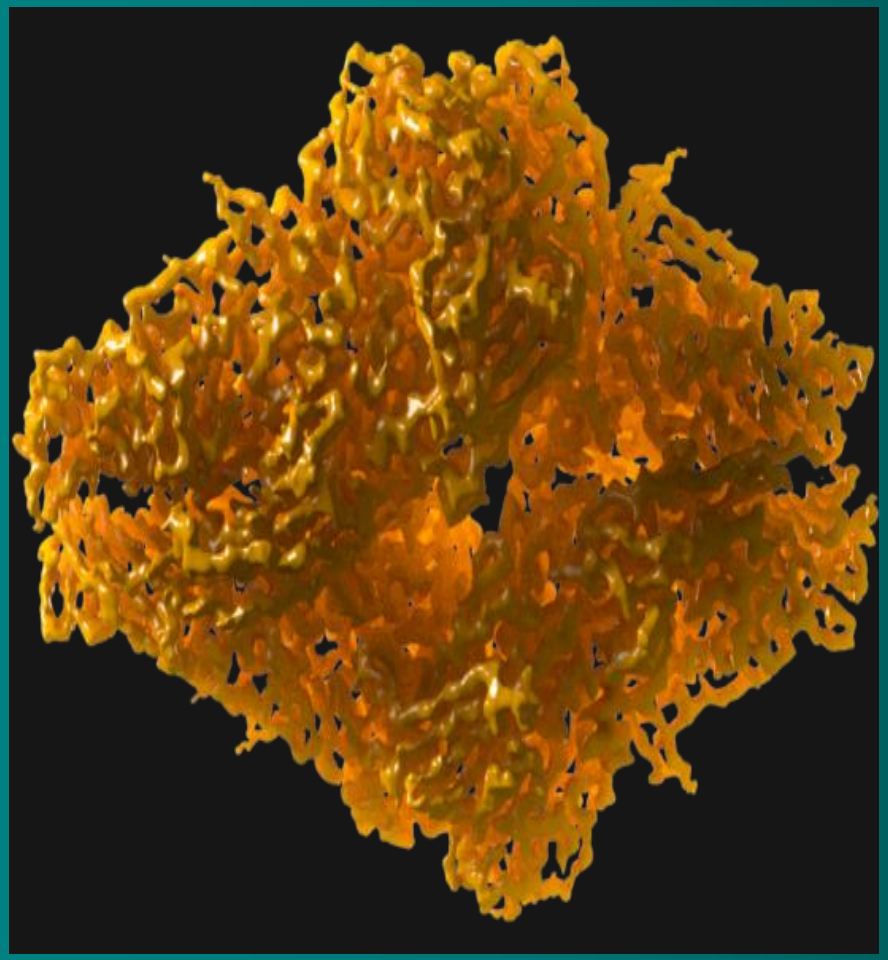
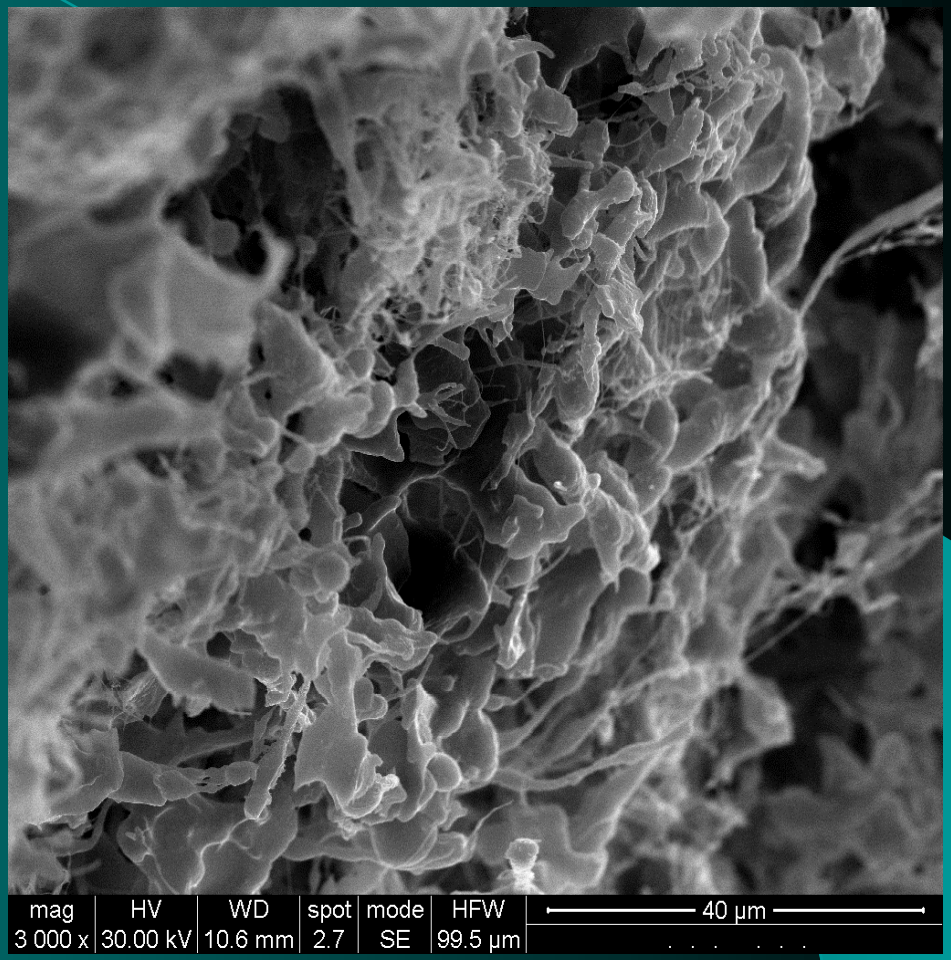
(AFM) The minimum measured height of fibrils is about 1nm, whereas their lengths are of hundreds of nanometres









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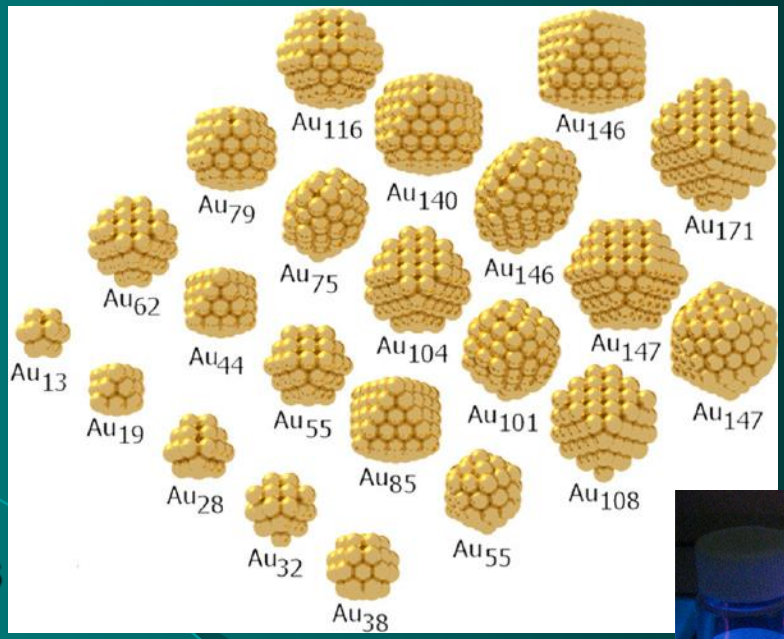
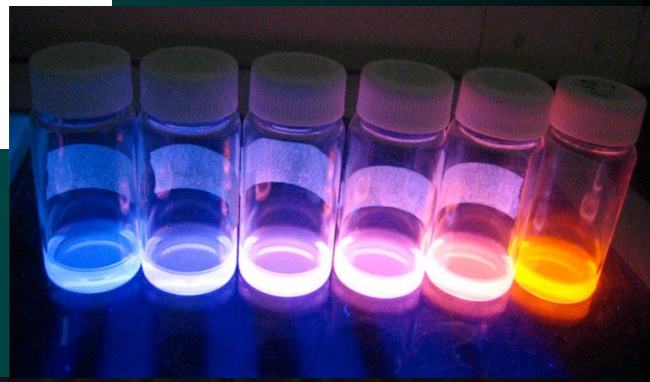
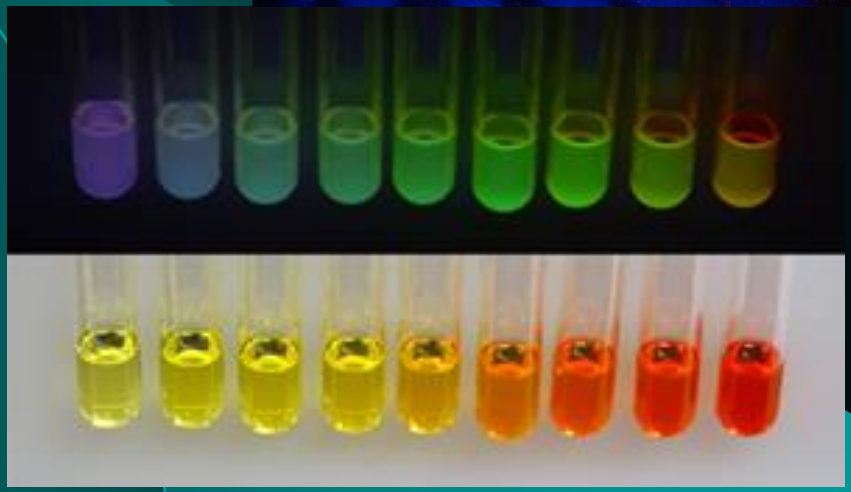


NO WONDER IF …

THE GOLD NANOPARTICLES



BEHAVE DIFFERENTLY … EVEN FLUORESCENT…



FROM BULK GOLD

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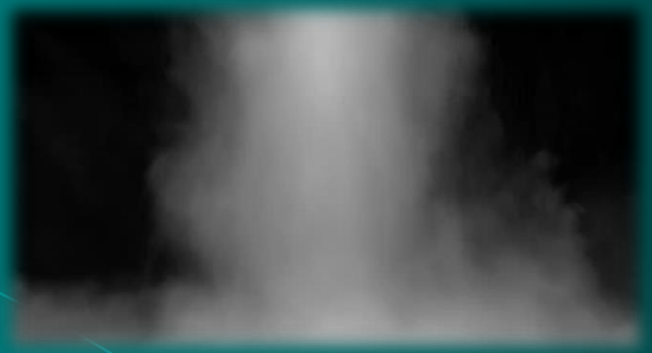
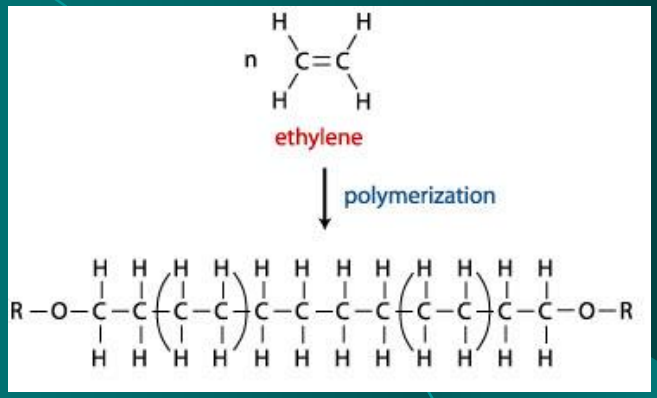


NO WONDER IF…

GAS ETHYLENE →



→ POLYMERIC SOLID POLYETHYLENE !!!!

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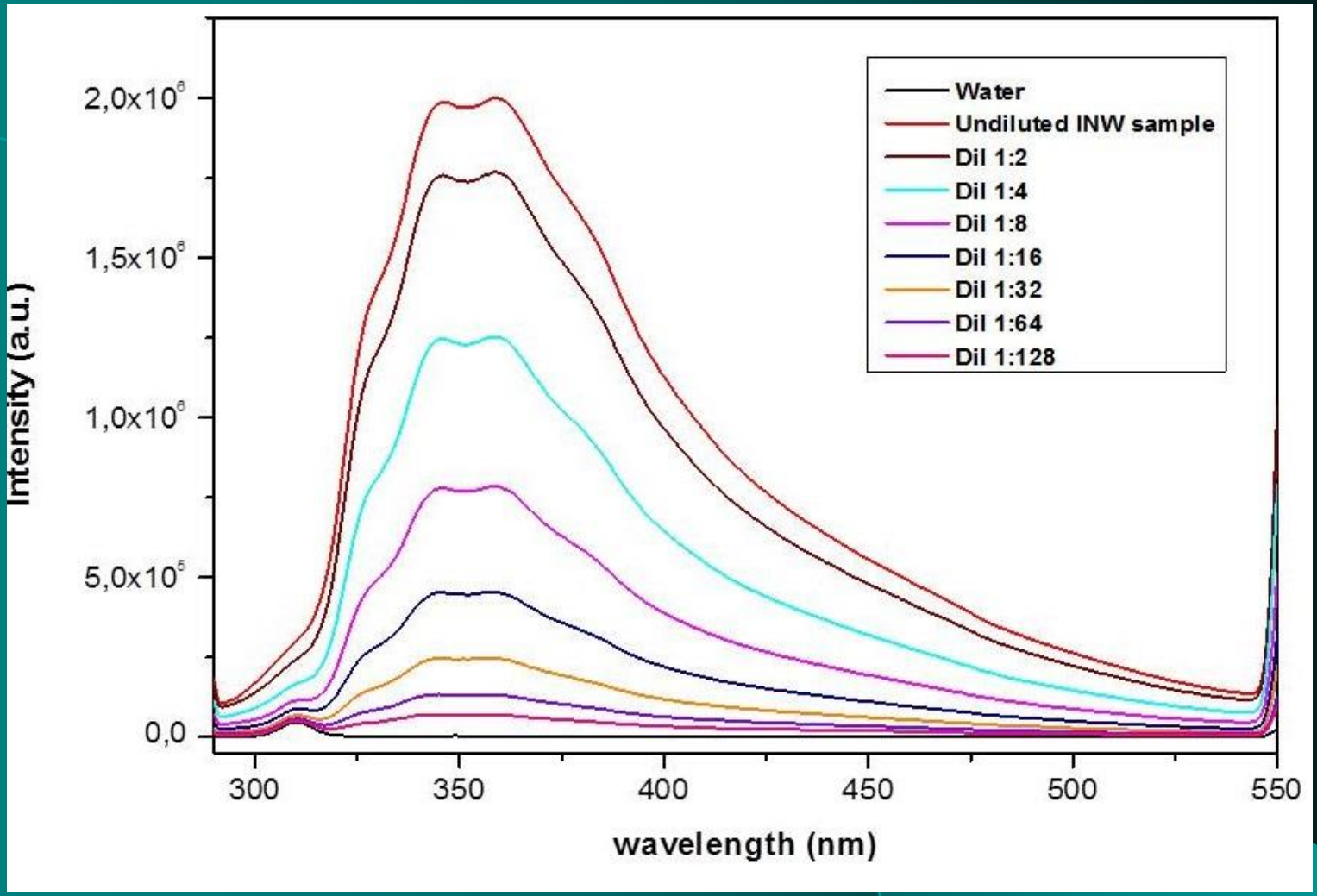
UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER



THE FIGURE PRESENTS THE UV-VISIBLE (UV-VIS) FLUORESCENCE SPECTRA OF AN INW SAMPLE, OF ITS SERIAL DILUTED LIQUIDS AND OF THE CONTROL MILLI-Q WATER. THE SPECTRA RESULT FROM EXCITATION OF THE LIQUIDS WITH 280 NM RADIATION.

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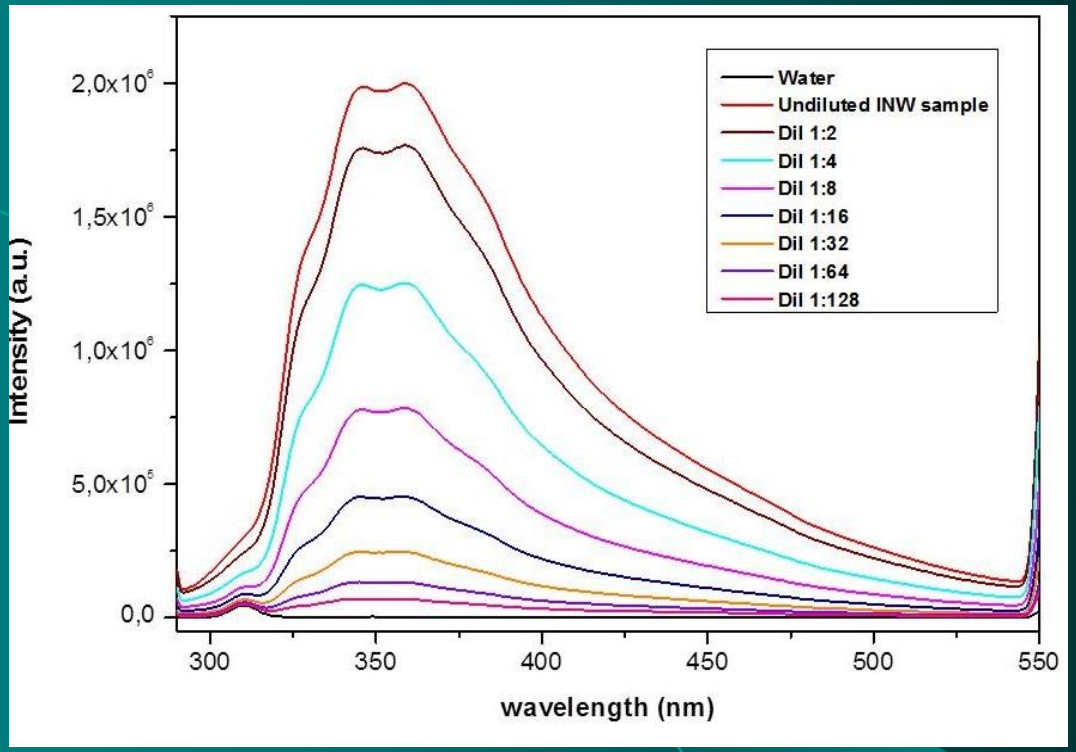
UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER



THE FLUORESCENCE INTENSITIES ARE PLOTTED AS FUNCTION OF WAVELENGTH IN nm FOR SAMPLES KEPT AT 25 °C.

THE RED LINE PRESENTS THE FLUORESCENCE OF AN INW SAMPLE WITH X_{INW}=1300 μScm^{-1}

THE COLORED LINES PRESENT THE FLUORESCENCE OF SAMPLES OBTAINED BY SUCCESSIVE DILUTIONS OF THIS X_{INW}=1300 μScm^{-1} SAMPLE.

THE SAMPLE WAS DILUTED WITH MILLI-Q WATER.

THE DILUTION RATIO (DIL) IS SPECIFIED IN THE INSET.

THE BLACK LINE PRESENTS THE FLUORESCENCE OF THE CONTROL, I.E., MILLI-Q WATER.

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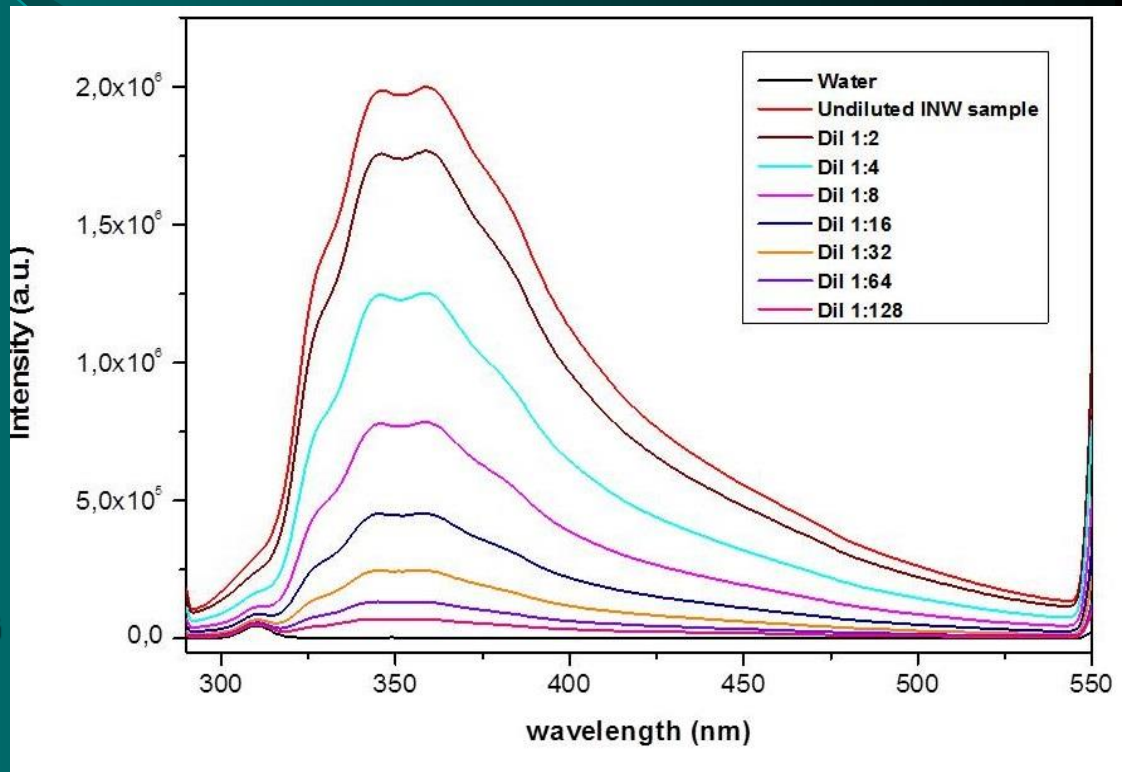
UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER

INW HAS A DISTINCTIVE ABSORPTION PEAK IN THE 250 - 320 nm RANGE WITH MAXIMUM AT 280 nm.

THE PEAK IS ABSENT IN BULK WATER.

INW'S FLUORESCENCE SPECTRA CONSIST OF A BROAD BAND SPANNING FROM 290 TO 550 nm.



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UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER

THE UV ABSORBANCE AND FLUORESCENCE SPECTRA OF INW RESEMBLE THOSE OF INTERFACIAL WATER ADJACENT TO NAFION MEMBRANES (WAN) (POLLACK)

THE UV ABSORBANCE OF INW MOST CLOSELY RESEMBLES THAT OF WAN AT A DISTANCE OF ABOUT 450 MICRON FROM THE NAFION MEMBRANE (WAN-450 nm).

IN PARTICULAR, INW AND WAN-450 HAVE IN COMMON THE STRONG ABSORBANCE ENHANCEMENT WHEN THE WAVELENGTH DECREASES FROM 240 TO 200 nm.

EXCIMER-TYPE UV-VIS FLUORESCENCE BANDS HAVE BEEN OBSERVED FOR WATER-ETHANOL MIXTURES AND VARIOUS AQUEOUS SOLUTIONS, E.G., SOLUTIONS OF LITHIUM CHLORIDE OR SUCROSE.

THE UV ABSORBANCE IN THE 240 - 200 nm RANGE HAS NOT YET BEEN CLARIFIED FOR WAN OR OTHER STRUCTURED WATERS.

ANALOGOUS ABSORBANCE HAS BEEN OBSERVED FOR MAGNETIZED WATER SUGGESTING THAT IT IS RELATED TO THE DYNAMICS OF ELECTRONS IN WATER.

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UV-fluorescence behavior of supramolecular H_2O architectures generated by perturbing pure water

Analyses (I)

We showed that perturbing pure water with a Nafion membrane and stirring leads to UV absorbance and fluorescence spectra attributable to micron-sized supramolecular H_2O aggregates.

These aggregates formed during the liquid-liquid transition triggered by the perturbations.

To spot contaminants and eliminate suspicion that these underlie our findings, we carried out extensive analyses.

Our mass spectroscopy analyses evince that the aggregates are composed of H_2O.

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UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER

ANALYSES (II)

OUR MALDI-TOF/MASS SPECTROSCOPY

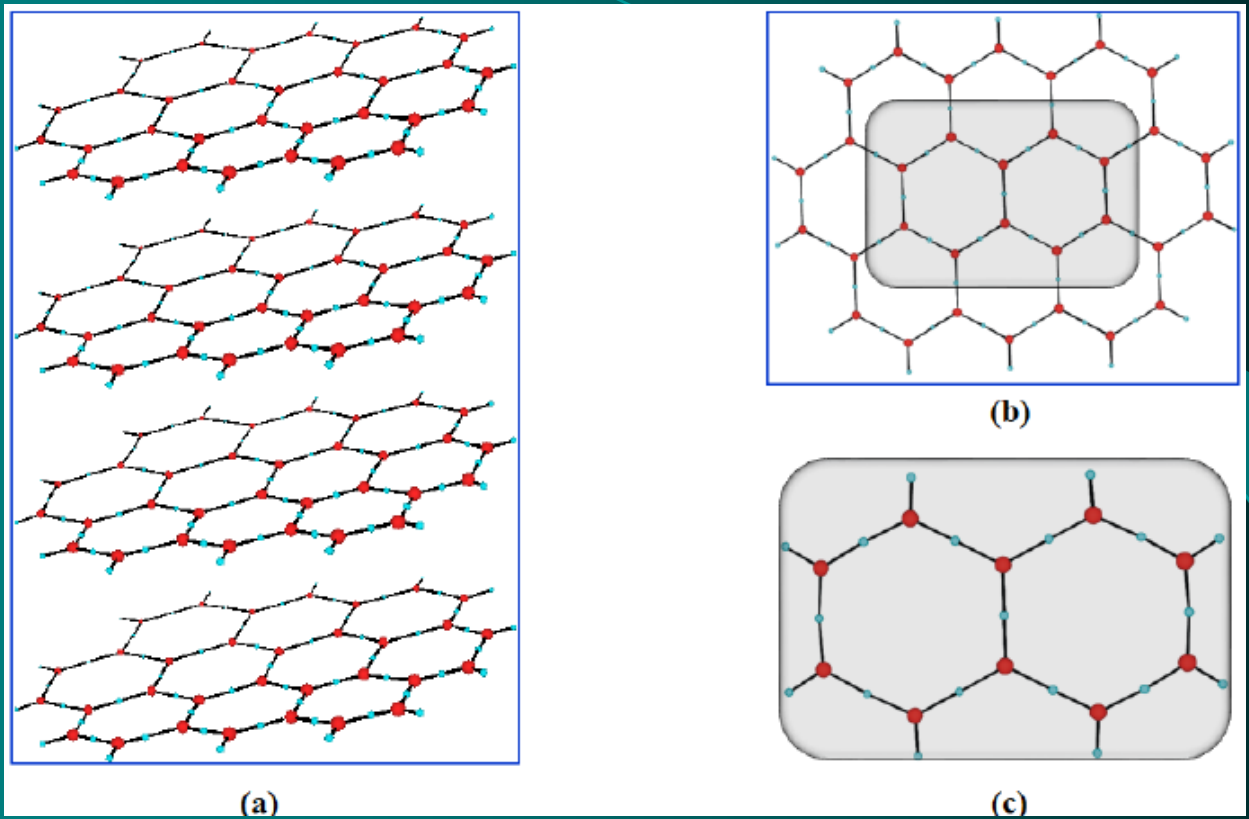
MATRIX-ASSISTED LASER DESORPTION/IONIZATION – TIME OF FLIGHT

AND GAS CHROMATOGRAPHY/MASS SPECTROSCOPY ANALYSES SHOW THAT ONLY MINISCULE AMOUNTS OF ORGANIC OR BIOLOGICAL CONTAMINANTS ARE PRESENT IN THE PERTURBED WATER. THESE CONTAMINANTS CANNOT ACCOUNT FOR FORMATION OF THE MICRON-SIZED AGGREGATES.

OUR ION CHROMATOGRAPHY ANALYSES SHOW THAT THE SOLE INORGANIC MOLECULES RELEASED BY THE NAFION MEMBRANES ARE FLUORINE AND SULFATE IONS. IN THE PERTURBED WATER, THESE IONS ARE PRESENT AT CONCENTRATIONS OF ABOUT 10^{-6} MOL / L. THESE IONS CANNOT ACCOUNT FOR FORMATION OF ITS MICRON-SIZED AGGREGATES, ITS HIGH ELECTRIC CONDUCTIVITY OR LOW PH.

(A) SCHEMATIC REPRESENTATION OF THE MULTILAYER HONEYCOMB ICE-LIKE MODEL.

(B) A TEN-HEXAGON LAYER.



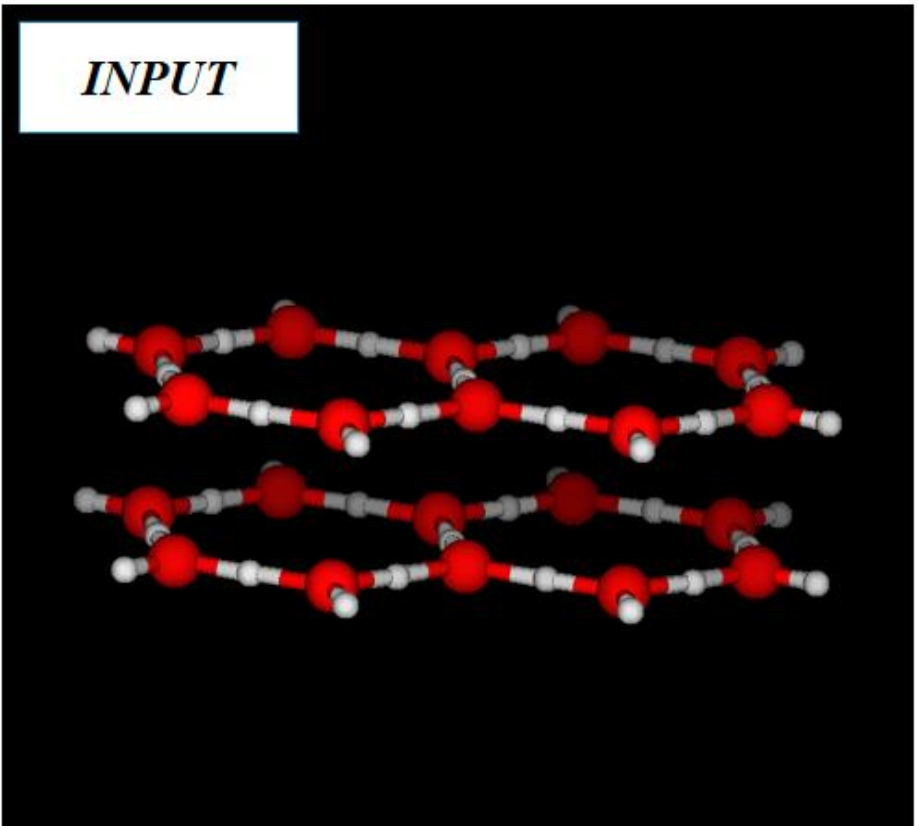
(C) THE $H_{19}O_{10}$ SYSTEM COMPOSED BY TWO FUSED WATER HEXAGONS IS THE MONOMER USED IN THE THEORETICAL STUDY:

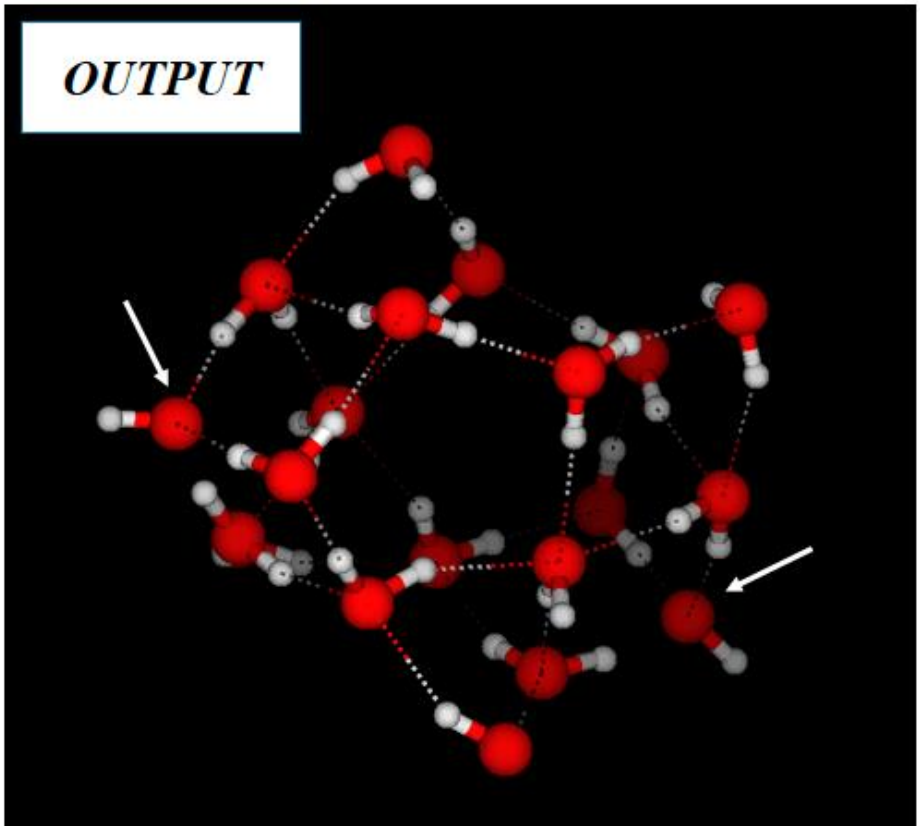
SEGARRA-MARTÍ J, ROCA-SANJUÁN D, MERCHÁN M (2014)

CAN THE HEXAGONAL ICE-LIKE MODEL RENDER THE SPECTROSCOPIC FINGERPRINTS OF STRUCTURED WATER? FEEDBACK FROM QUANTUM-CHEMICAL COMPUTATIONS. *ENTROPY* 16 (7) : 4101-4120.

WHEN TWO $[H_{19}O_{10}]^-$ ANIONIC SYSTEMS ARE SITUATED IN A PARALLEL ORIENTATION AT 2.4 Å WITHIN THE CONSTRAINTS OF D_{2H} SYMMETRY (INPUT), GEOMETRY OPTIMIZATION OF THE RESULTING GLOBAL SYSTEM $[H_{38}O_{20}]^{2-}$ LEADS, AFTER A LONG OPTIMIZATION PROCESS WHERE THE ORIGINAL SPATIAL SYMMETRY IS LOST AND BREAKING OF THE WAVE FUNCTION OCCURS, TO THE BULK-TYPE WATER AGGREGATE DISPLAYED IN OUTPUT.

Segarra-Martí J, Roca-Sanjuán D, Merchán M (2014)
Can the hexagonal ice-like model render the spectroscopic fingerprints of structured water?
Feedback from quantum-chemical computations.
Entropy 16(7):4101-4120.



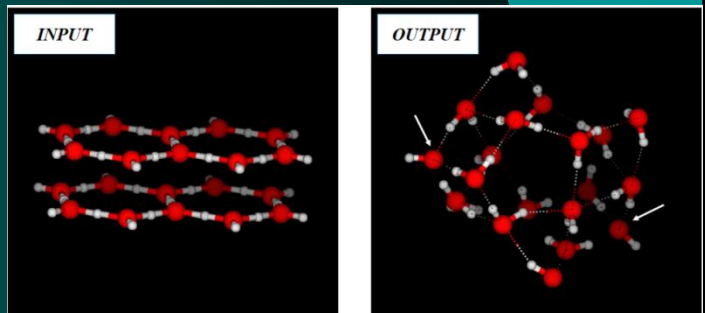


FROM: SEGARRA-MARTÍ J, ROCA-SANJUÁN D, MERCHÁN M (2014)
CAN THE HEXAGONAL ICE-LIKE MODEL RENDER THE SPECTROSCOPIC FINGERPRINTS OF STRUCTURED WATER? FEEDBACK FROM QUANTUM-CHEMICAL COMPUTATIONS. *ENTROPY* 16 (7) : 4101-4120.

THE SPECTROSCOPIC FEATURES RECORDED FOR STRUCTURED WATER ARE FULLY CONSISTENT WITH THOSE COMPUTED FOR THE NEUTRAL MOLECULAR MODELS USED TO DESCRIBE THE ESSENTIALS OF THE MULTILAYER HONEYCOMB ARRANGEMENTS.

THE NEUTRAL Π-STACKED DIMER $[H_{38}O_{20}]$ HAS BEEN REVEALED TO BE PARTICULARLY SUITED FOR THIS PURPOSE,

BOTH FOR THE ABSORPTION AND FLUORESCENCE EVENTS.



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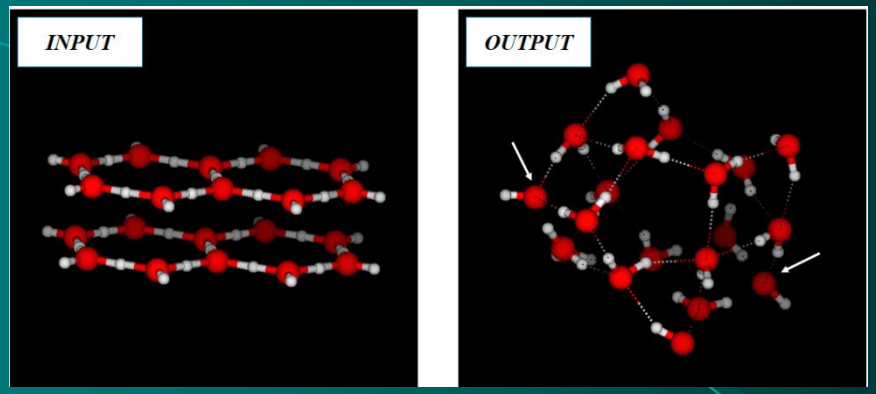
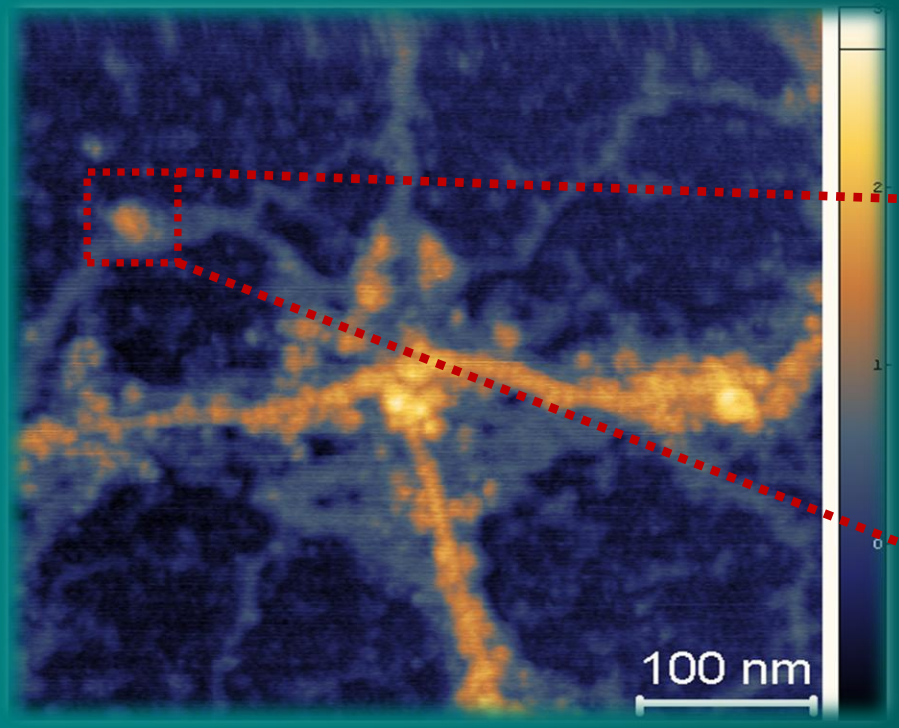
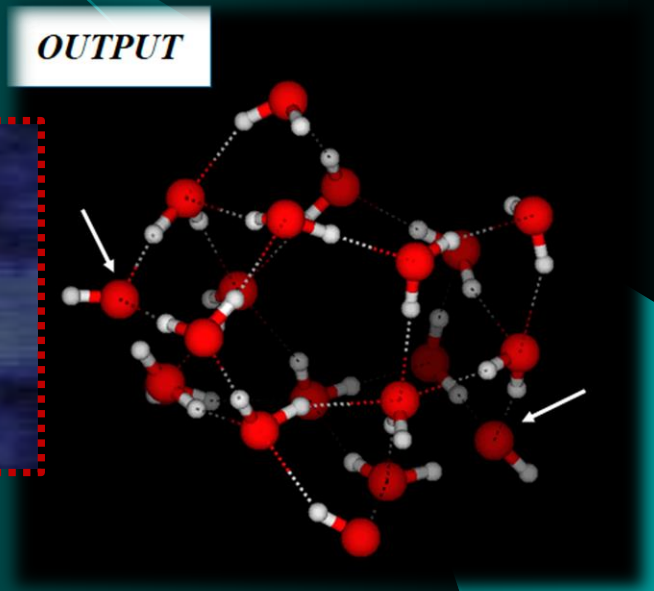
THEREFORE, THE RESULTS PROVIDED FULLY SUPPORT THE SCENARIO ENVISIONED IN THE REALM OF BIOLOGY BY ALBERT SZENT-GYÖRGYI. IN THE CONCLUSION SECTION OF THE BOOK ENTITLED "BIOENERGETICS", PUBLISHED IN 1957, HE STATED:

"LUCRETIAN BIOCHEMISTRY INVOLVES THE ASSUMPTION THAT NO INTERACTION CAN TAKE PLACE BETWEEN MOLECULES WITHOUT THEIR TOUCHING ONE ANOTHER. SUPPORT IS GIVEN IN THIS BOOK TO THE IDEA THAT MANIFOLD INTERACTIONS CAN TAKE PLACE WITHOUT SUCH BODILY CONTACT, EITHER THROUGH ENERGY BANDS OR THROUGH THE ELECTROMAGNETIC FIELD, WHICH THUS APPEARS WITH WATER AND ITS STRUCTURES AS THE MATRIX OF BIOLOGICAL REACTIONS."

QUANTUM CHEMISTRY SHOWS INDEED THAT WATER MAY FORM STRUCTURES THAT ABSORB AND TRANSMIT ENERGY PRECISELY IN THE SAME ENERGY RANGE AS THAT ARISING FROM AROMATIC AMINO ACIDS AND DNA/RNA NUCLEOBASES.


INPUT
OUTPUT


100 nm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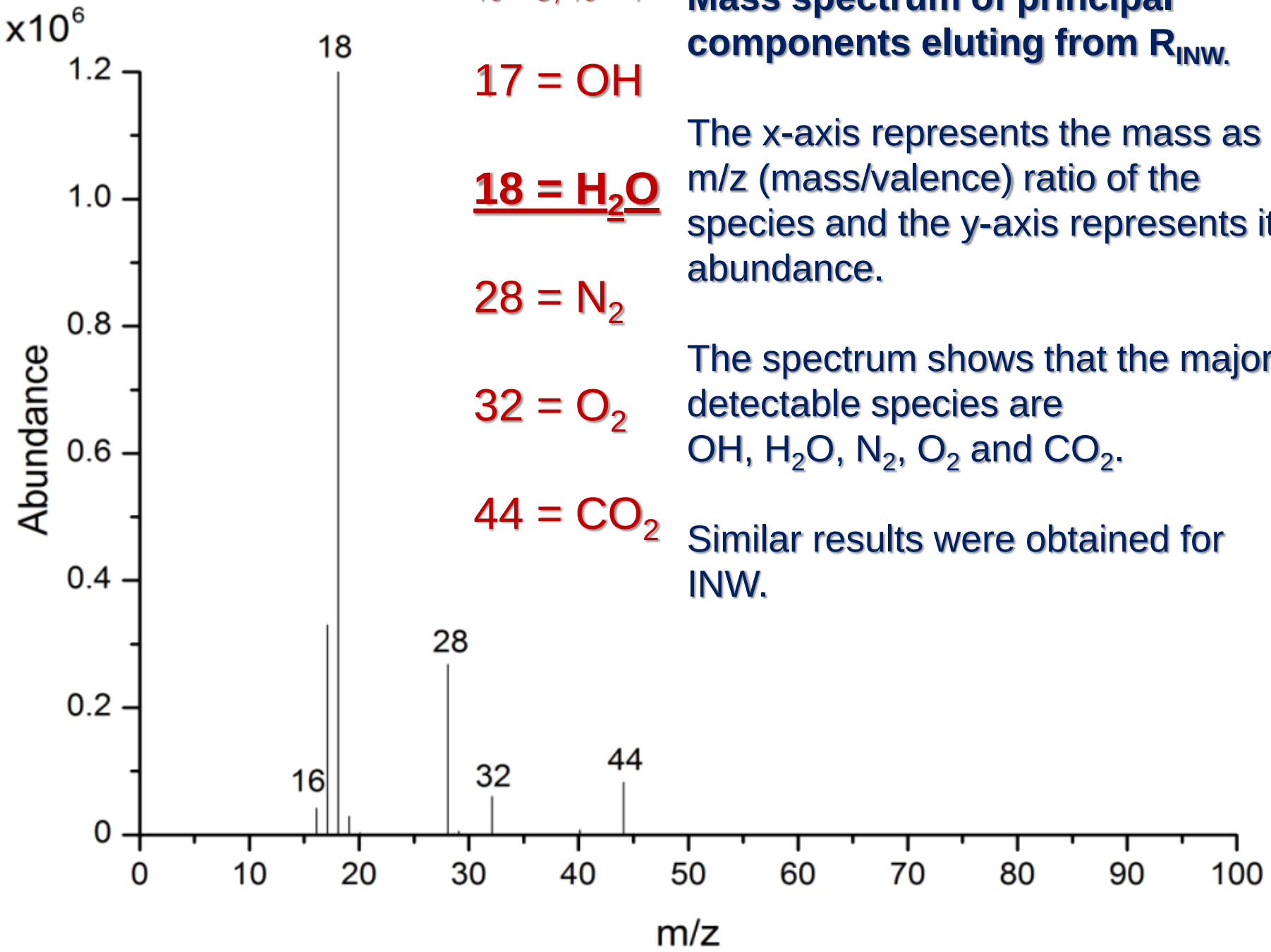

16 = O, 19 = F

17 = OH

18 = H_2O

28 = N_2

32 = O_2

44 = CO_2

Mass spectrum of principal components eluting from R_{INW}.

The x-axis represents the mass as m/z (mass/valence) ratio of the species and the y-axis represents its abundance.

The spectrum shows that the major detectable species are OH, H_2O, N_2, O_2 and CO_2.

Similar results were obtained for INW.

PROBABLY, IT MAY IMPORTANT TO HIGHLIGHT THAT UP TO NOW THE PAPERS PUBLISHED BY US ON THESE VERY STABLE AGGREGATE OF PURE WATER ARE THE FOLLOWING:

1) V. Elia, E.Napoli, Dissipative Structures in Extremely Diluted Solutions of Homeopathic Medicines. A Molecular Model based on Physico-Chemical and Gravimetric evidences, *International Journal of Design and Nature*, 5 (1), 39-48, (2010)

2) V. Elia, G. Ausanio, A. De Ninno, F. Gentile, R. Germano, E. Napoli, M. Niccoli, Experimental evidence of stable aggregates of water at room temperature and normal pressure after iterative contact with Nafion polymer membrane, *WATER*, 5, 16-26 (2013)

3) V. Elia, G. Ausanio, F. Gentile, R. Germano, E. Napoli and M. Niccoli, Experimental evidence of Stable Water Nanostructures in Extremely Diluted Solutions, at Standard Pressure and Temperature, *Homeopathy*, 103, 1, 44-50 (2014)

4) V. Elia, G. Ausanio, A. De Ninno, F. Gentile, R. Germano, E. Napoli, M. Niccoli, Experimental Evidences of Stable Water Nanostructures At Standard Pressure And Temperature Obtained by Iterative Filtration, *WATER*, 5, 121-130 (2014)

5) V. Elia, R. Germano, E. Napoli, Permanent Dissipative Structures in Water: Experimental Evidences and their Quantum Origin, *Current Topics in Medicinal Chemistry, 15,* 6, 559-571 *(2015)*

6) R. Germano, Water's Permanent Dissipative Structures Quantum Origin And Life, *Electromagnetic Biology and Medicine*, 34, 2, 133-137 (2015)

7) V. Elia, T.A. Yinnon, R. Oliva, E. Napoli, R. Germano, F. Bobba, A. Amoresano, Chiral micron-sized H2O aggregates in water: Circular dichroism of supramolecular H2O architectures created by perturbing pure water, *WATER*, 8, 1-29 (2017)

WATER

Large Supramolecular Water Clusters Caught on Camera - A Review

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Key Words: Stable water clusters, Supramolecular clusters, Quantum coherent domains

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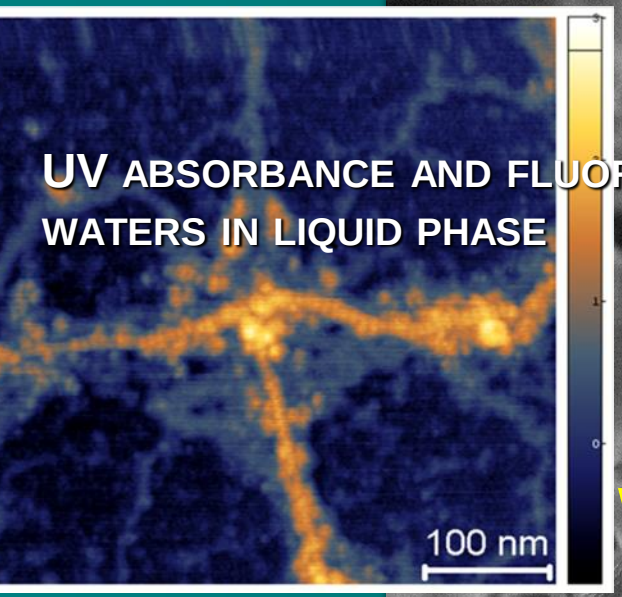
UV-FLUORESCENCE BEHAVIOR OF SUPRAMOLECULAR H_2O ARCHITECTURES GENERATED BY PERTURBING PURE WATER



CONCLUSIONS

UV ABSORBANCE AND FLUORESCENCE SPECTRA RESEMBLE THOSE OF OTHER STRUCTURED WATERS IN LIQUID PHASE

BUT

WE ISOLATED A NEW SOLID MATERIAL

AT NORMAL PRESSURE AND TEMPERATURE

CONSTITUTED BY SOVRAMOLECULAR STRUCTURES OF H_2O:

XEROSYDRYLE

mag	HV	WD	spot	mode	HFW	40 µm
3 000 x	30.00 kV	10.6 mm	2.7	SE	99.5 µm	

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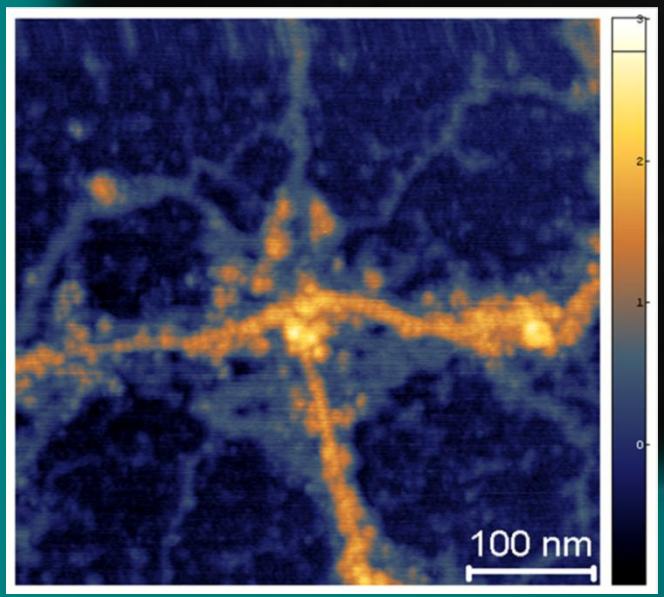
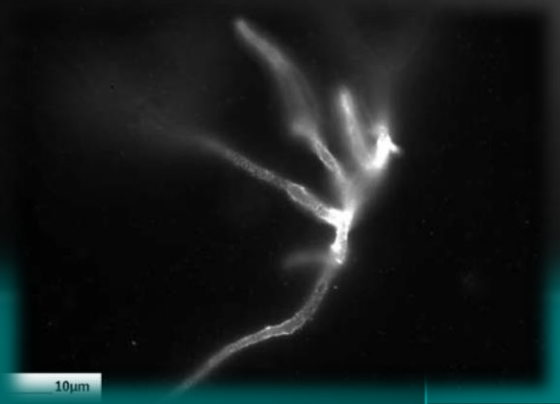
IT IS POSSIBLE TO BEGIN TO INVESTIGATE THE NATURAL HYPOTHESIS
THAT THESE SPONTANEOUS DISSIPATIVE SYSTEMS
FORMING IN PURE LIQUID WATER (MADE BY H_2O)

ABLE TO "CONDENSE" IN CERTAIN CONDITIONS
AND BECOMING SOLID AT AMBIENT TEMPERATURE AND PRESSURE,

MAY BE THE MATRIX OF LIFE ITSELF





I DEDICATE THIS TALK TO THE LIVING MEMORY OF MAE WAN HO

THANK YOU FOR YOUR ATTENTION !!

germano@promete.it