Biosphere
We Are Water

Juan Pablo Orrego Silva

ECOSISTEMAS

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Author, editor, and coordinator: Juan Pablo Orrego Silva
Edition assistant: Mitzi Urtubia Salinas
Layout first edition: Magdalena Larraín Bórquez
Illustrations and reeditions' layout: Josefina Carvalho Soler

English revision, with many thanks: Tom Butler, Joe Willie Jones and Lindsi Krusko.

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In this document Magic and Mystery
is represented by ice crystals.

The best or worst proof of the disconnection of human beings with nature is what is happening with waters around the world... We will return to this.

But we need to start by saying that water is magic. It is enough to sprinkle the earth with this fluid, 'liquid,' colorless, transparent, and odorless element for life to sprout. This liquid that wets, cleans, washes, waters, dissolves, and transports; that extinguishes fire and quenches thirst. All extraordinary actions that water performs, that we often take for granted. Magic and Mystery .

"If there is magic on this planet, it is contained in water." Loren Eiseley, The Flow of the River, 1957.

◂ A remarkable molecule ▸

H_2O is a remarkable molecule. A tetrahedron, a bipolar triangle.[1] Two hydrogen atoms[2] positively charged; the simplest and most abundant element in the universe, precursor of all other elements, and one atom of the famous vital oxygen[3], negatively charged, the third most abundant element after hydrogen and helium, which we breathe in with each whiff of air. The

Many properties of water derive from the tetrahedron shape of its molecule.

[1] *Water Ecology*, Alicia Hoffman y Juan Armesto, Corporación Instituto de Ecología y Biodiversidad, 2014.
[2] Symbol **H**, in the biosphere it is more commonly found in its gaseous molecular form $\mathbf{H_2}$.
[3] Symbol **O**, I the biosphere more commonly found in its gaseous molecular form $\mathbf{O_2}$.

quantum precise molecular geometry means that the hydrogens—with an approximate separation of 105° between them—are located on 'one side' of the atom, and only the oxygen on the other. Thus, the molecule is positive on one side and negative on the other. This bipolarity allows the solid linkages of the water molecules between them: "the molecules are attracted and connected through unions called links or hydrogen bonds."[4]

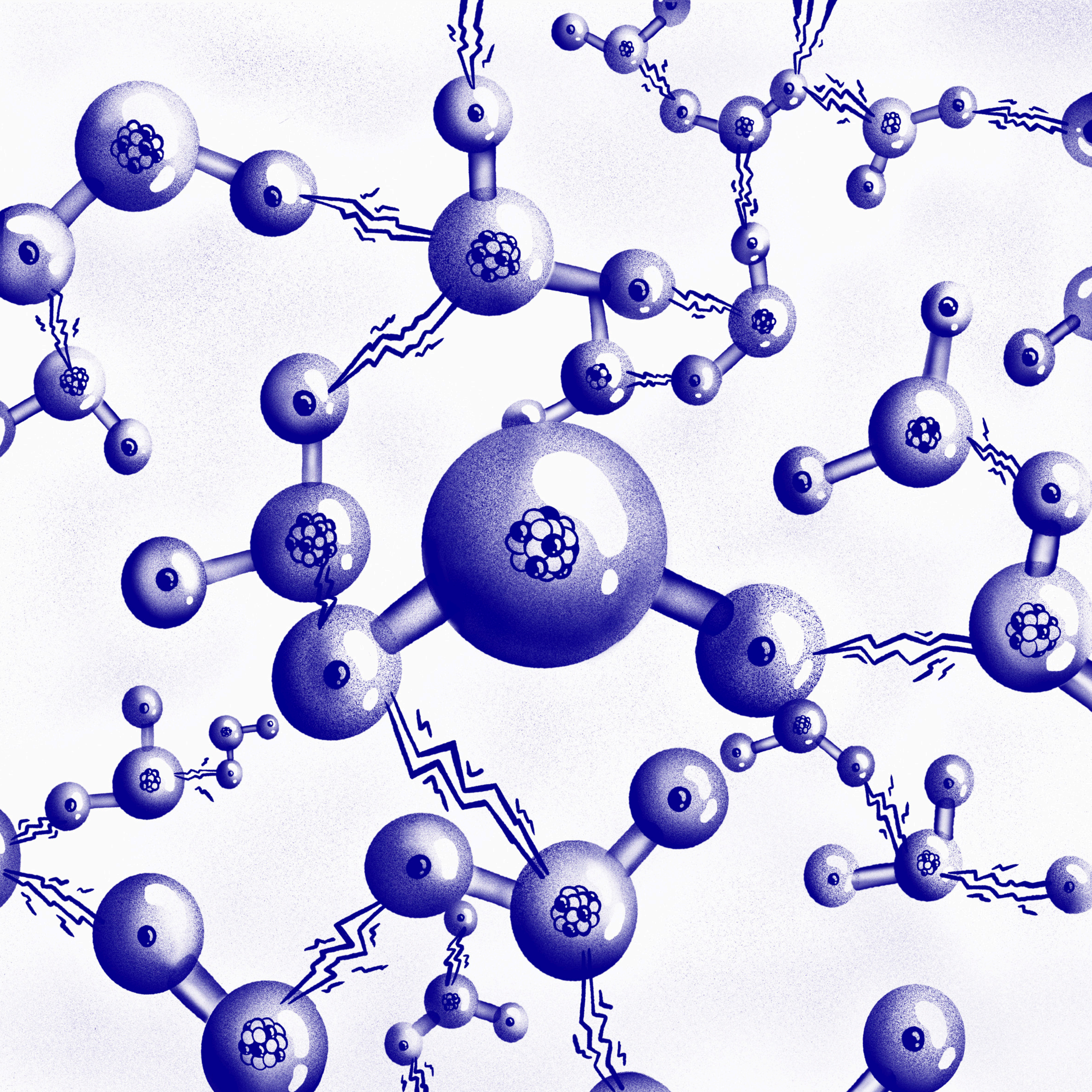
"Water is a three-dimensional network of tetrahedrons."[5] Although it is hard to believe, the molecule is 0.985 Angstroms in size; a little less than one Å, a unit that represents 0.0000000001 of one meter (one ten-billionth of a meter). In fact, water is an emergent quality of millions of these, for us, infinitely small molecules of H_2O. Just one molecule of water does not wet, water, or dissolve. Bipolarity also makes it possible for water molecules to bond with countless other molecules of other elements.

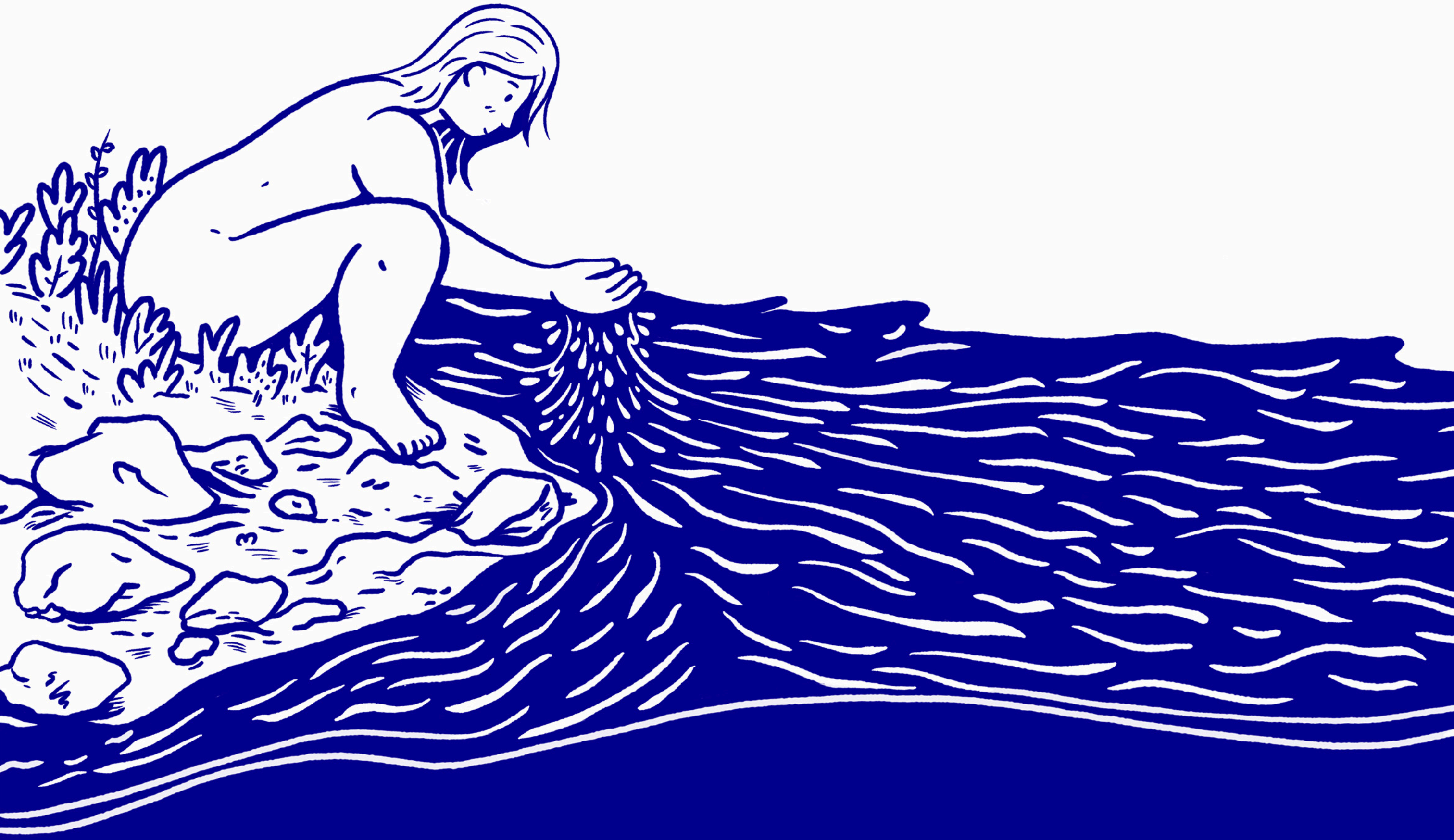
In comparison, a red globule has a diameter of 0.007 mm, 60 times more than a virion (virus particle or individual) of 0.00012 mm.

Enzymes need this 'aqueous' media, water, which is really an electronic medium, for their tridimensional shape to adopt an active form.

[4] *Water Ecology*, Alicia Hoffman y Juan Armesto, CIEB, 2014.
[5] Ibid.

Atmospheric air enters our organism with 78% nitrogen, 21% oxygen, 0.04% carbon dioxide, 0.93 % argon, and traces of other gases which circulate throughout the atmosphere, including vaporized water. The 'air' we exhale has 16% oxygen and 3.5% CO_2, and water vapor. Thus, approximately 5% of the oxygen of the air we breathe enters our metabolism. The blood comes out of the pulmonary aorta with its hemoglobin saturated with O_2 at 97%. After being liberated to the tissues through capillary blood vessels, the hemoglobin's O_2 diminishes to 70%. In other words, 27% of the blood's O_2 is taken by cells for metabolic functions. Of the breathed CO_2 15% also combines with hemoglobin, forming desoxyhemoglobin, 10% dissolves in blood plasma, and the 75% left is transported by the bicarbonate ion.





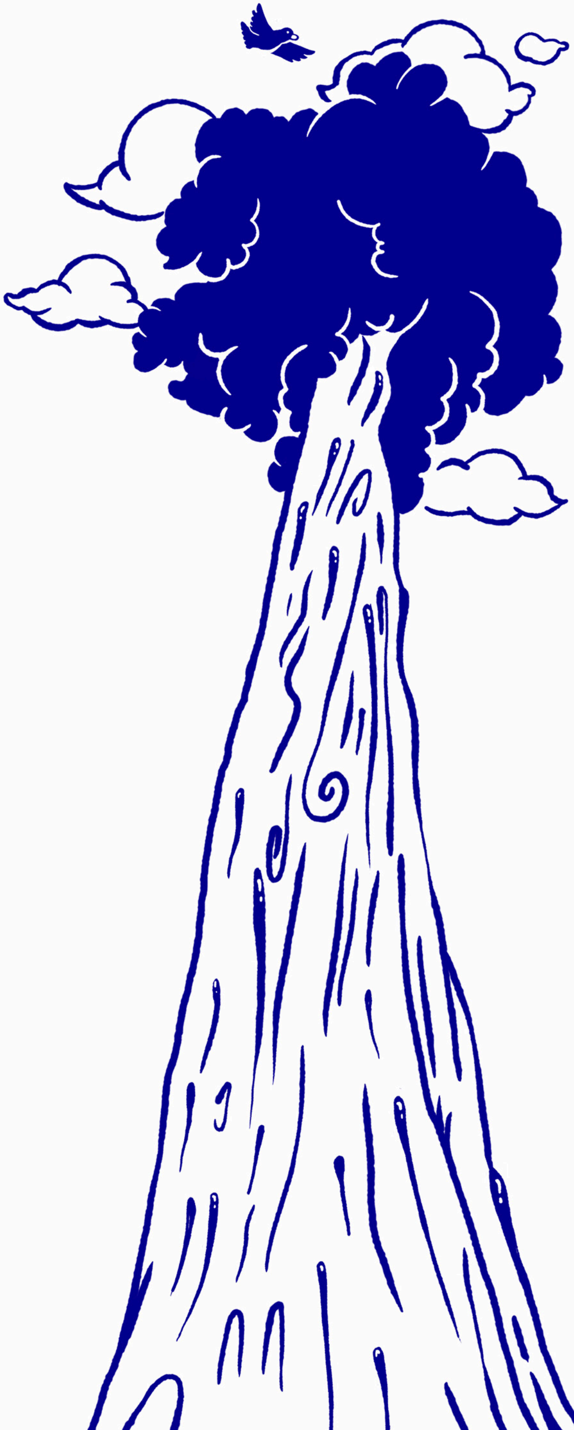
Just as we do not know for sure how water arrived on Earth, we also do not know with certitude how its complex molecular network is structured. Science has observed variations in terms of how many hydrogen bonds of one molecule of water can link with the oxygen atom of another water molecule. Recent research indicates that each molecule can bond with another four, with two links though its oxygen atom, one through each hydrogen atom. This 'variable geometry', which is not completely understood by science, could have to do with water's capacity to change its state with temperature fluctuations, as well as with the peculiar qualities of the liquid element which allows it to be the matrix of the living .

Curiously, hydrogen and oxygen by themselves, in their gaseous form, are flammable. Oxygen is the 'soul of fire,' but when these two elements marry in this peculiar way, this extraordinary substance is generated, which conversely, 'puts out' fire. The results of countless other combinations of these two elements with others are as incredible as this one; but, without a doubt, water is the most amazing!

◂ Extraordinary properties ▸

Water is endowed with extraordinary physical and chemical characteristics, qualified as 'anomalous', which makes it unique, and which allows it to be the matrix of the living in an extremely precise, and ultra-adaptative way. Water takes all forms.

'Burning' is the chemical reaction of two atoms or molecules combining and releasing energy in the form of heat. 'Fire' is the result of the very rapid and energetic combining of 'fuel' molecules with oxygen atoms, an oxidizing process. An example of slow, 'non-burning' energy release, is the oxidation of iron and other metals, that we call 'rusting'. Water 'puts out' fire by introducing a barrier between the fuel source molecules and the oxygen atoms. It acts thus because water is a completely oxidized molecule. It cannot oxidize any further so it will not 'burn.' This causes water to smother the fire. The same effect occurs with any other ***100%*** *oxidized material such as ashes –burned/oxidized wood–, or any other molecule that is completely oxidized like CO_2. CO_2 gas is used for fire extinguishers. A secondary effect that makes water efficacious at extinguishing fires is that it cools off the temperature of the burning material below what is necessary to keen burning. It does this by 'robbing' heat from the fire while converting from liquid into vapor.*



The attraction that holds the water molecules together is called *the cohesion force*, which, among other effects, produces on the surface of the liquid what we call *surface tension*. Light objects float on it; various insects can slide quickly and accurately over this electronic film.

When we humans put our hands in water, we perceive—an interface between the H_2O network, our sensitive skin, nerves, and brain—this three-dimensional network of electronically linked bipolar tetrahedra as the vital and familiar 'liquid' that wets and cleanses us. If we drink it, it flows fluid down our esophagus, enters our body's bio-ecosystem, and 'quenches' our thirst. There is a call from our body to our mind indicating that it is necessary to incorporate more water into the system to maintain metabolism... life, flowing. Water that enters and leaves, given that we also constantly return it to the environment.

Water's polar molecules adhere to electrically charged surfaces; we call this *the adhesion force*. These two complementary 'forces' –*cohesion and adhesion*– produce the miraculous water capillarity in all plants, including the largest trees. Adhesion causes water molecules to stick to the inside of a capillary vessel and rise, driven by the upward circulatory dynamics of gases and liquids in the tree, particularly the significant evapotranspiration of H_2O, and the gaseous 'respiration' –absorption of CO_2 and exhalation of O_2. Diurnal solar photosynthesis in between. On the one hand, the cohesion among the molecules makes the molecules that ascend adhering to the wall of the vessel drag those that are at the center of the capillary. Thus, without much effort, or generating heat, the holy water rises to the tip of the last leaf at the top of the highest Alerce and Sequoia .

The interplay of these two 'forces', complemented by other extraordinary qualities of water, makes possible its movement through the soils and the complex geology of the earth, playing a key role in the gradual disintegration of rock masses. Thus, the waters in their liquid and solid state, together with solar radiation and other natural 'phenomena', work tirelessly so that the rocks and stones over time produce mineral earth, to which the living later delivers organic material, producing soils. In this way begin ecological successions that can end up elevating a magnificent forest on the land.

Water has a *high evaporation heat* compared to other liquids. This is necessary so that it does not escape or evaporate easily from bodies of water, including ours, and those of all organisms, all water based.

Water also has "mysterious thermal stability"[6] based on *high specific heat* —the amount of heat needed to raise the temperature of one gram of any substance by 1° C. Raising the temperature of water requires significantly more heat than for other substances. Its specific heat is 1. That of iron is 0.1. Its temperature increases one degree with a tenth of the heat that water requires for the same effect. Water changes temperature more slowly. Paradox? We perceive water as fragile and iron as strong.

In some animals, such a medusae -water jellies-, which are 99.5% water, this 'compact liquid' of H_2O molecules constitutes its 'hydrostatic skeleton', which gives the organism its shape and structure during its whole life. Equally, its well differentiated organs are made almost only by water organized as those organs. Medusae have been called 'live waters.' Similarly, most fungi, and other organisms, such as algae, are mostly water.

◂ Water and the living ▸

The thermal properties of water are designed with a level of precision, literally atomic, molecular, and beyond... so that water can have this multidimensional capacity to incorporate into, and to transform itself into all forms of life who inhabit planet Earth and who together make up the biosphere. Since the bodies of living beings contain a high percentage of water, this acts as an internal *buffer* to avoid extreme and rapid variations in temperature. This allows organisms, to inhabit habitats as dissimilar in terms of temperature and humidity as the Atacama Desert and the Amazon rainforest. In 385 B.C., Aristotle concluded that "nature abhors a vacuum":

[6] Ibid.

all possible ‘niches’ on Earth are occupied and used by the living. One could say, then, that it is water that abhors a vacuum. Diverse water-based beings can live deep inside the deepest cavern, in the hottest hot spring in a scorching desert, in the most hypersaline lagoon, in the ice in Antarctica, up to the highest treetops of the Amazonian arboreal giants.

As the temperature drops, water contracts and its density augments. But below 4° C, the density begins to decrease again. Paradoxically, the hydrogen bonds strengthen, and the mobility of the molecules decreases. “Upon reaching 0° C, the hydrogen bonds become so strong that the water molecules are rigidly connected to each other, with a lot of air between them, and form a network of hydrogen bonds that turn it into a crystal.”[7] “This air is the reason why ice is lighter than liquid water and floats on its surface.”[8] Cold increases the volume of water! So, ice is water crystallized, but anomalously expanded, with air inside it, morphing into a solid state in which it remains at 0° C or lower. Only two compounds and five elements of the periodic table have this peculiarity: water, acetic acid, silicon, germanium, antimony, bismuth, and plutonium. All other compounds and elements contract at low temperatures and expand with heat. If it were not for this capacity or quality of water, the ice would sink

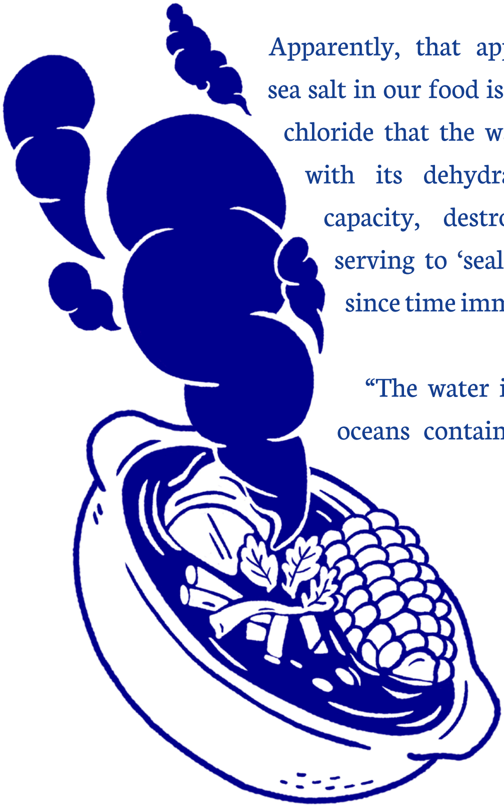
[7] Ibid. Emphasis added.
[8] Ibid.

to the bottom of lakes, seas, and oceans, accumulating from the bottom up towards the surface. This would make all aquatic life impossible in water bodies located in frigid territories .

In fact, also, apparently paradoxical, the layers of ice that float on the bodies of water act as a *thermal insulator* preventing the water below from freezing. Fish, penguins, seals, polar bears, and countless other aquatic beings, dwell in icy waters under the shifting, moving ice, which also always carries to the sea minerals and organic matter from their terrestrial origins, feeding the marine food chain and creating the interfaces between fresh and saline waters; usually the most ‘productive’ waters, supporting a greater diversity of life, such as those of rivers’ estuaries.

Water is the most powerful solvent in nature; it has been called a *universal solvent*. “It can dissolve a wide variety of inorganic compounds and other liquids and gases that have negative or positive charges.” Thus, for example, common salt, sodium chloride (NaCl), composed of one sodium atom (Na^+) and one chlorine atom (Cl^-), ‘dissolves’ in water. This means that the H_2O molecule, with its positive and negative charges, attracts the sodium and chlorine atoms separately, thus dissolving —disassembling— the molecule of common

salt, so that the atoms of the two elements diffuse into the aquatic environment and fulfill their role of 'salting' rice or beans. The salty taste in food is not that of the sodium chloride compound, but rather the result of the Na and CI chemistry, acting separately but in a complementary way, as a solution in the stew.



Apparently, that appreciated flavor of sea salt in our food is that of sodium and chloride that the water separated. Salt, with its dehydrating, hygroscopic, capacity, destroys bacteria, thus serving to 'seal' and preserve food since time immemorial.

"The water in rivers, lakes, and oceans contains diverse dissolved inorganic compounds, including nitrates, phosphates, and carbonates. These simple compounds are essential nutrients for living organisms. Plants absorb the nutrients dissolved in soil water through their roots and use them to synthesize the complex organic molecules that make up their stems, leaves, and flowers."[9] And fruits! 'Only' with water, minerals, air and sun, autotrophic, photosynthetic organisms, or 'primary producers,' such as plants, photoplankton, algae, and some bacteria synthesize their own carbohydrates, lipids, and proteins. The 'manna from heaven' ❄ that feeds us, the universe of heterotrophs, *who depend on others*. Not all of us recognize and venerate daily these wonderful beings who have a privileged, more direct, and extremely functional, relationship with the star Sun. Very literally, our life depends on them.

Photosynthetic organisms are the 'champions' of the living, constituting the only exclusive input pathway of solar energy into the biospheric macro ecosystem. Reverence to them.

The Earth is situated in an extremely precise circumstellar zone, that we have called 'habitable', because as 'water-beings' we could not have evolved in any other environment. How things came to be this way is also something to ponder about. So far, we have not found a similar star/planetary arrangement in our 'proximity'.

Curiously, water was on Earth long before the development of the first microscopic forms of life based on water. How can that be? So, was water divinely designed in an incomprehensibly peculiar way to become, millions of years later, the matrix, the vehicle of all life ❄? Or could it be that all of life developed out of and around the many 'miraculous' qualities of water? Life continues adding Magic and Mystery…

[9] Ibid.

The H_2O molecule is extremely stable, also because of its ability to change states with different temperatures, instead of being destroyed by heat or cold, as happens with other compounds. **Water is the only compound that occurs naturally in three physical states on this Earth**. It flows permanently among the three states mutating from one to the other in a circular, recursive cycle. Below 0° C, it solidifies in the form of ice or snow, and it expands anomalously, as we said. Above 0° C, it becomes and remains liquid, and as the temperature increases, it tends to evaporate. At 100° C, it evaporates quickly. On this planet, the three states coexist and intermingle in what we call the water cycle or the 'hydro-logical' cycle. The truth is that the 'logic' of water is quite special and quite beyond our understanding.

◂ Aquatic origin of life ▸

Let us continue... As far as we know, about 3.8 billion years ago, life arose from water, from the sea, *Aramara*; from the 'primordial soup' as biologists call it. New studies indicate that this 'soup' was not, to begin with, just a random boiling mixture of minerals. Chemists have been looking into the early presence of cyanide (HCN) derivatives in the boiling seas, a family of deadly poisons. Biospherical humor, and apparent paradoxes! This would explain, according to advanced chemists, the gradual emergence

The indigenous Wirrarika of the Western Sierra Madre in Mexico, known as Huicholes, name seas and oceans, Aramara, mother of waters, given that clouds emerge from them and bring the rain to the land.

Sea water has a pH between 7.5 and 8.4, so, neutral or slightly alkaline. Blood plasma, sweat, tears, inter and intracellular liquids are all in ranges close to neutrality, around pH 7.

from these compounds of more complex molecules, ancestors of nucleic acids, and of amino acids which were encapsulated in oily clay bubbles... Our science does not explain the quantum leap from the chemical and physical to the biological. It has not been reproduced even in the most sophisticated laboratories with vast budgets.

Water-based life. We are walking water!

All organisms, all beings, so-called organic, biological, are water. Water that stands up tall like a tree with roots to absorb water and leaves to evapotranspire it; water that blooms in the forms of flowers; water that becomes juicy fruit; that flies like a bird in humid air; that crawls like a reptile over hot arid soil. Water that swims in the water and harvests its oxygen from the same water with its gills; water that runs like guanaco and choique (Patagonian rhea), gazelle and leopard; water that moans, that meows like a puma, that growls like a bear, that walks, talks and sings like a human...

In the bodies of all the beings of the five 'kingdoms,' water is the most abundant vital element: bacteria 85 percent; protoctists or algae 98; fungi 80-90; animals between 70 to 99.5, from humans to jellyfish; and plants, from 75 percent of a woody tree to 90–95 of lettuce or spinach.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◂ Water in the human body ▸

In a human, 60 percent of the water is inside the cells and the rest in the blood and tissues. As we all know, to dehydrate is to die. It is not necessary to lose all our body water —49 liters in a person weighing 70 kilos— to die of dehydration. For this 70-kilo person, the loss by dehydration of 10 percent of body weight, so 4.9 liters of water, has a grave, perhaps fatal effect. The loss of 20 percent of body weight —9.8 liters of water— due to dehydration leads to certain death because of the cessation of metabolic functions for which water is essential.

The human body is 70 percent H_2O average; the brain and heart 90; blood 83; lungs, liver, and kidneys 70-80; muscles 76; bones 22; fat tissue 10.

On average, there are 5 liters of blood in the body of a human being. Blood which is 80-90 percent water and 10-20 of solid elements.

Under normal conditions, on average a human being moves between 2 and 2.5 liters of water daily. That is, we incorporate that amount from the environment through drink (1,400 ml/day), food (700), and water produced in the cells (*metabolic water*, 300) and eliminate the same amount through urine (1,500), lungs (400), skin (350) and feces (150). If we stop drinking fluids, the recursive cycle is interrupted, and despite the various containment mechanisms that begin to operate, such as the secretion of antidiuretic hormone, the body will inevitably continue to lose its quota of water. The loop is cut and only the loss of water continues operating.

Metabolic water: water made by cells oxidizing fats or starch; they obtain 0.6 gr of water per gr of starch and 1 gr per gr of fat. Vital for inhabitants of deserts and arid regions. In human beings the constant production of metabolic water is around 0.3 l/day with a normal diet.

A human fetus is 95 percent water. A baby 90. Adults are 70 percent water. An old man can get to be 60 percent water and, curiously, an old woman can end up being only 50 percent water. In other words, growing and getting old is literally to gradually lose our body's water, to dry up, to wither... The cells lose their capacity to retain water in the tissues, and the kidneys, and other organs related to this function weaken. This loss is not reversed by drinking more and more water. The growing dryness will occur gradually and inevitably, due to the system's wear.

The human baby is connected though the umbilical cord to the placenta, an organ which develops and implants in the mother's uterus during pregnancy. Through the walls of the uterus, of the placenta, and of the blood vessels of the umbilical cord, the baby receives the nutrition and the oxygen from the mother for its development and connects to the mother's vital metabolic functions. Through the same circuit, but on reverse, the metabolic waste and carbon dioxide produced by the baby are evacuated to the mother's circulatory system for their elimination. During pregnancy, the baby floats in the amniotic fluid -almost a liter at 34 weeks. So, our first environment in life is in all sense aquatic. We even have rudimentary gills during the first phases of fetal development. When we are born, we draw our first gulp of air into our lungs, but clearly, 'waters are first.' If all goes well, the mother gives again everything to the baby through another liquid produced by her mammary glands, mother's milk. Gradually we transit to the blessed water of the 'external' world, and to the solid food generated with earth, water, and sun.

Under normal conditions, water is such a good solvent, though, that it grabs, carries away, sodium and potassium —the popular electrolytes— in the urine and stools, such as excrement, that has a significant water content in healthy digestion. Acute diarrhea can dehydrate and carry away electrolytes from the body in a dangerous way.

Excrements with which we also evacuate between 100,000 and 400,000 fecal coliforms daily. One gram of human feces can contain up to 1,000 million different kinds of virions.

Thus, our metabolism requires that we recover and reincorporate electrolytes and renew the 'three-dimensional network of electronically linked tetrahedra' , that is, the water which we are continually excreting to the environment through exhalation, sweat, urine, saliva, tears, and excrement. **Our body moves a loop of water, a small … and not so small, circular river: 2.5 liters a day, 17.5 liters a week, 75 liters a month, and 900 liters of water a year.** This is the water that under 'normal conditions' —without strenuous physical activity and in moderate temperature conditions— enters and leaves our body. In extreme conditions, the amounts recycled can increase significantly.

900 liters multiplied by the actual human population of 7,802,234,482,300 result in 7,022,234,070,000 liters of water (7.022.234.070 m^3) recycled by humanity annually! A figure which is difficult to apprehend or visualize. By the Amazon River, the world's largest, flow 209,000 m^3/s, so 6,591,024,000,000 m^3/year… Humanity moves annually almost 10% of the daily flow of the Amazon.

As has been said, losing even a few liters of water is enough to make the metabolic functions begin to decline and, if the trend is not reversed, eventually fail. At the same time, due to its specific heat, water does not leave the body so easily. In the Atacama

Desert, the mummification of a corpse can take between one and twelve months. However, depending on the conditions, in the same place –zero humidity and high dehydrating salinity– a human body can lose most of its vital waters in a few days.

◂ Water in the biosphere ▸

Water is nature's vehicle.
L. da Vinci.

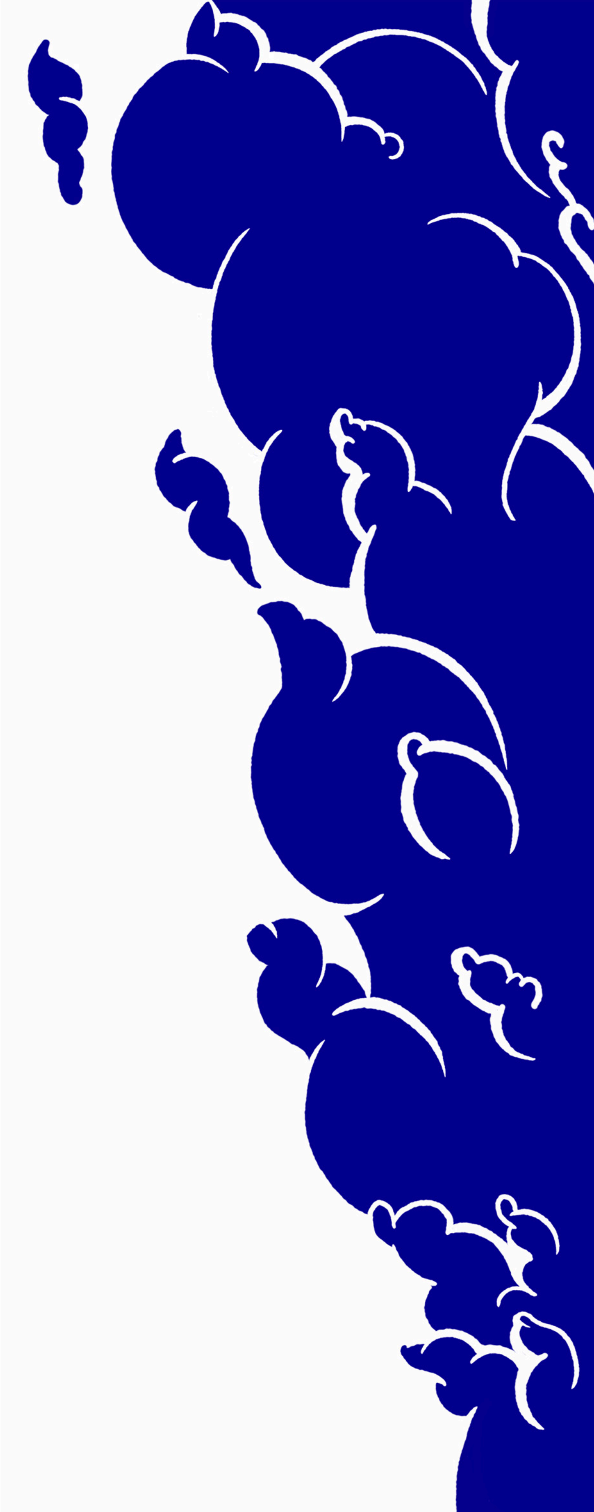
Just like our bodies, the biosphere in its entirety is also probably 70 to 80 percent water. And the biosphere –the living– is in fact a continuum with seas and oceans, cryosphere, and atmosphere, with rivers, lakes, and wetlands. All these systems are more than interconnected; they are interpenetrated. They flow from and into each other, and all contain, or are entirely water. They are a single life system based on water, a huge, multidimensional cycle of matter, energy, and information spanning from the molten core of the Earth to the infinite Cosmos. They are a wheel that 'ascends' driven by the lightness, levity and synergy generated by the sun and the bioecological process, and 'descends' under the influence of gravity and entropy.

We 'westerners' have perceived separate systems –the chemical, the physical, the geological; the atmosphere, cryosphere, hydrosphere, biosphere; 'coupled' up like the gears of a machine. However, **we are part of an interwoven atomic and molecular space-time continuum...** and water is one of the fundamental elements that gives it its body and moves the whole system.

"It is calculated that on Earth there are 1,386 M km^3 of water. That is, 1,386 x 10^{18} liters; 1,386 followed by 18 zeros!"[10] And 'western' science calculates that in each liter of water, there are 3.34 x 10^{25} molecules of water. Better not even try multiplying these figures because the result is not comprehensible. The infinitesimal is transformed into the immeasurably big. These quantities are impossible to visualize. Other worlds. The world of the micro-microcosm raising the macrocosm. And that unimaginable infinitesimal dimension allows... powers up... 'puts the floor' to our intermediate dimension, so to speak: the biosphere; of which we are part, located 'strategically' between the micro and the macrocosm. "As is above, is below," perceived and expressed Paracelsus.

Seventy percent of the planet's surface is covered with seawater of varying depths, reaching abyssal trenches of 11,000 meters. The 'water tables' flow inside the planet, the aquifers; there are underground lakes and rivers. Thousands of rivers and streams run above, over the globe, dotted with countless water bodies including lakes, lagoons, wetlands, swamps, and estuaries. The entire system is inextricably interconnected, generating the

[10] Ibid.



global 'hydrological cycle' which ranges from the microscopic drop of water in a bacterium, to a human who exhales water while contemplating the marvelous clouds that float in the earth's atmosphere, to the vast salty oceans' curved horizon.

It is hard to believe, but most of the water on Earth circulates constantly and rapidly except for fossil waters trapped in deep aquifers, or polar ice, whose cycle is much slower than in other water bodies, but which can also acquire fast movement due to some natural phenomenon that changes environmental conditions. It is enough to look at a great river to be amazed at the amount of water that passes before our eyes per second, in perpetual motion —from our fleeting point of view— which can make us dizzy, or to contemplate the incessantly moving and changing sea.

This is the water circulation system, the planetary hydration system which makes the light, transparent blood of the biosphere flow.

Majestic clouds circulate through the atmosphere —water vaporized by the sun and evapotranspired by plants, trees— often charged with astonishing amounts of electricity that are discharged in the form of lightning and fierce rays. How do ethereal 'clouds' of H_2O go about charging and discharging these huge amounts of electricity? Clouds: floating three-dimensional networks of bipolar tetrahedra of H_2O electronically linked, which can generate, store and release electricity.

The excitation caused by heat weakens the hydrogen bonds and moves the molecules away from each other, significantly reducing, in the infinitesimal dimension, the density of water, which mutates to 'gaseous.' Thus, it ascends and floats in the sky and is

spread across the face of the Earth by the winds and atmospheric circulation. At the same time, this flow of vaporized water, as well as marine currents, make up a mega system of global thermal circulation. In other words, they distribute heat throughout the planet. We can say that waters also drive the climate on Earth.

Water made into clouds, agglomerated thanks to dimethyl sulfide gas, which is emitted by photoplankton (marine algae or protoctists) that is then processed by bacteria... And on the land, plants doing their part to produce atmospheric humidity... Much symbiotic cooperation among the ‘kingdoms’ to generate the innocent but indispensable clouds. Bacteria, algae, and plants cooperating. As usual.

All animals exhale thousands of liters of water in a lifetime. As noted, humans move approximately 2.5 liters of water daily. We constantly return water to the environment, even when we cry. We drink and drink and drink water, of course, and other beverages, which mostly consist of water, such as tea, coffee, beer, colas, juicy fruits, and fruit juices, and so on. Even a 'distillate' like *whiskey* generally is 60% water.

Forests call water... if they have not been destroyed yet by the human hand. They move water from the coasts to the interior of the continents. Today called the *biotic pump*. Forests, with their thirst, generate pressure drops which attract winds, and with them, the waters suspended in the atmosphere. In the Amazon basin, more water flows through the sky than over the ground. Where does the river end and the sea begin? Where does the sea end and the clouds begin? Where does the forest end and the humid atmosphere begin? It is a mega loop of entangled water and life.

And beware! The water that exists on 'plane-t' (round-et?) Earth (Water?) is the same since it landed on 'this strange rock.' It is not known for sure how and when exactly water reached the primeval igneous planet, newly created from stardust. One hundred million years of hail? Gigantic ice asteroids that crashed into Earth? Hydrogen and Oxygen in chondrites?

Water does not leak out of the atmosphere. In fact, atoms' champion, hydrogen, could escape our planet's system if it were not incorporated in water. Waters are a way of retaining vital hydrogen, one of the six fundamental elements for life, on planet Earth. This most abundant element is largely incorporated into water, and thus into the biosphere's water-based living diversity.

The atoms fundamental for life are six: Hydrogen, Oxygen, Carbon, Nitrogen, Phosphor, Sulfur.

As far as we know, the planetary system is closed in terms of the cycle of matter; the planet does not receive or lose significant amounts of matter. Instead, the system is open in terms of the energy cycle; it constantly receives energy from the sun and radiates or 'loses' heat outwards; the planetary energy cycle which, 'manipulated' by humanity with excess greenhouse gasses is fast veering towards climate chaos. **In the past, other natural phenomena have modulated the biosphere's cycles of matter and energy –of the climate, of water, of the living– and of information (DNA), with vast consequences and surprising planetary transformations.** Other ages have come and gone: Bacterial biosphere, of algae and fungi. Biosphere with dinosaurs. Biosphere with mammals and humans. This one, the last of the series... Planetary pulses.

◂ Humanity and waters ▸

So, then, after this tremendous turn of the story, if it is the same water that has been here since the origins of the planet, why are there so many problems with supplying water to all kinds of communities, nonhuman and human, to bioregions and ecosystems? Why are there so many mega-droughts and desertification processes in our time?

The macro-ecosystem biosphere has always been highly fluctuating, dynamic, and changing, but within given parameters and cycles. It is a system dotted with randomness and mega discontinuities such as ELE or Extinction Level Events. There are numerous examples. The chain eruption of volcanoes north of Siberia 235 million years ago annihilated 90 percent of the biosphere —an extinction that paleontologists call "the Great Dying." A meteorite impact in the Gulf of Yucatán 66 million years ago annihilated 70 percent of the living. There is no moral judgment on those responsible for these biospheric cataclysms. Meteorites and volcanoes have no choice; they do what they do. Period!

Paleontologists have detected 12 ELE in the far past, and 5 of enormous magnitude, including the two just mentioned. In other words, the biosphere is used to ELE and is reborn with new biotic assemblages thanks to the extremophile bacteria, whose descendants have all been present on the planet since the origins of life on Earth. They resist everything, even ELE. They withstand infernal heat, acids,

caustic or hypersaline aquatic environments, extreme pressures, and lack of oxygen. There are fungal/bacterial webs for miles under the Earth's mantle; these are lithoautotrophic microscopic beings which feed on minerals and have no metabolic link with the external biosphere. These organisms can be perceived as the most recondite repository of vital resilience of the biosphere. There lies the phoenix, which from the ashes can raise another biosphere. Life is everywhere and is indestructible for as long as the sun is in its 'beneficial' or benign phase, kindly lightning up life on this planet.

What is happening now is another process of global biospheric change, a gradual ELE that has accelerated in recent decades. It is taking the rapid dynamics of a geometric progression, graphed in a steep exponential curve. Many biospheric variables today can be graphed with steep upward curves that are increasingly vertical: the human population explosion, social disorder, violence, cancer, vascular accidents, deforestation (60 percent of forests destroyed), pollution, the accumulation of garbage in gigantic quantities; the loss of biodiversity; of large sea fish (90 percent); of amphibians

and coral reefs (50 percent); of terrestrial and marine “predators,” and so on. All these processes of change, including the extinction of species, are accelerating. This process can also be visualized downwards: as a cascade rushing down a precipice.

The current ELE has the novel characteristic of being gradual rather than sudden and of being driven by a new —a very new— natural, biological phenomenon, a living geological force: humanity! This is the reason why scientists and activists speak of the sixth great biospheric extinction in Earth history, which is in the making, being caused by humankind. We should be able to avoid being a destructive force for our own extended body, our ‘home,’ but we are not achieving it.

*The first primates, placental mammals, appeared some **100** million years ago. Diversification of apes, **5** M years ago. Human ancestors, **4** M years ago. Closer ancestors, **1.65** M years ago. Humans anatomically alike modern humans, **200** thousand years ago. Homo Sapiens, culturally similar with modern humans, **50000** years ago. Temporally nothing in terms of the **3800** M years’ history of the living. Represents only **0.013%** of it.*

There is a broad consensus that the global water crisis is due to our lousy biospheric ‘management’ —our clumsy way of inhabiting this biosphere, in thermodynamic terms— which ignores the system's ‘operational guidelines’. It includes having caused climate change through the degradation of all water residences: oceans, seas, glaciers, hydrological basins, forests, rivers, lakes, wetlands, estuaries, as well as the living community that we call biodiversity such as flora, fauna, algae, and fungi… Many water-containing and water-circulating organisms destroyed.

Similarly, much of the carbon that is currently floating in the Earth's atmosphere in the form of carbon dioxide, producing the greenhouse effect, is directly proportional to all the life that we, humanity, have destroyed. The living, from tiniest bacteria to tallest trees to us are net carbon catchers. People are carbon sinks. We can also perform many other synergistic functions for a thermodynamically good planetary physiology, e.g., our ability 'to domesticate,' to diversify, to disseminate, and even to create crops, like corn. **If we destroy the living, we destroy its ability to store or 'incorporate,' to make bodies with carbon, from the micro to the macro, and to incorporate, to make bodies with, and to recirculate water, from the micro to the macro.**

Thus, humanity has been acting as an enemy, destroyer of the waters and their residences. Of water-based nature.

Why? A grave and profound lack of biospheric culture, of environmental culture, water culture, oceanic and marine culture… hydrological basin, river, wetland, and lakes' culture. Disconnection.

We do not know, we are not taught the real non-anthropocentric, non-neo-Darwinian history of the biosphere, not even in our famous universities. Too much specialization, too much "tunnel vision," as

Theodore Roszak [11] put it . We do not understand our origins. They do not teach us what our true place is in this biospheric community. Who are we? Where do we come from? Where are we going?

◂ Aquatic bacterial origin of life ▸

The truth is as intimidating as it is humbling. **The truth is that we come from bacteria. We are a dancing galaxy of atoms and molecules... and we are a bacterial and viral constellation.** The mitochondria that produce energy through cellular respiration in most protoctists (algae), all animal, plant, and fugal cells, are descendants of some of the oldest bacteria in biological creation, blue-green bacteria, or cyanobacteria; so are the plasmids, key for photosynthesis in some protoctists, and in all plants and algae . That is how interconnected in space and time everything is in this story of life; that is how connected the past and present are in this epic story. Today we are full of bacteria on the skin, hair, eyes, ears, armpits, genitals, stomach, and intestines. We cannot digest well without our, mistakenly, so-called bacterial 'flora'; we do not have plants living in our digestive systems and should instead call it our digestive bacterial galaxy. Some have already realized this and call our crucial gut community the intestinal biota.

Mitochondria capture the atmospheric CO_2, use the carbon for their bodies and liberate the oxygen to the air. They produce adenosine triphosphate, ATP, the energy molecule which animates our bodies.

In the chloroplasts and using the sun's energy, the water molecules are 'torn apart' to harvest their hydrogen, which combined with the carbon obtained from CO2 allows the organism to make DNA, proteins, sugar, and other cellular components. The oxygen is also liberated to the atmosphere.

[11] *Where the Wasteland Ends: Politics and Transcendence in Postindustrial Society*, Theodore Roszak, Doubleday & Co., Garden City, New York, 1972.

A biosphere intertwined with mutualisms, driven by symbiogenesis, and made more complex by serial endosymbiosis.[12]

We owe our life, literally, to archaic bacteria, so-called extremophiles because they arose from the extreme conditions of the igneous, acidic, caustic phase of the planet, of a mortal 'primordial soup,' mortal for us, their descendants.

They gradually created the conditions for the emergence of increasingly exuberant biospheres and increasingly complex multicellular life forms, growing up to planetary bioecological networks such as the current one. However, according to Lynn Margulis, the increased complexity and multicellularity came at a cost: programmed death.

If the conditions of their ecological niche are maintained, bacteria, unicellular or multicellular, prokaryotes —with their DNA swimming freely in their aqueous internal environment— are immortal. They clone, they replicate, ad infinitum. We, eukaryotes —with our DNA confined in a membrane-bounded nucleus— complex multicellular organisms, have a programmed death. Even if fate happens to provide us with the best bioecological conditions, we will still die.

[12]We suggest studying the work of the microbiologist Lynn Margulis: *Microcosmos*, L. Margulis, D. Sagan, 1985; *What Is Life?* L. Margulis, D. Sagan, 1995; *The Symbiotic Planet*, L. Margulis, 1998; *Kingdoms and Domains*, L. Margulis, M. Chapman, 1st edition 1982, 4a 2010.

We owe our lives to bacteria and little-known protoctists: algae such as cochayuyo (Chilean tubular seaweed), luche (sea lettuce), nori seaweed, amoebas, and diatoms. The latter, with astonishing siliceous crystalline forms, are a fundamental link in the marine and oceanic food chain fed with sediments provided by rivers.

Saltwater dressed as algae climbed on the earth, giving rise to animals, fungi, and plants. Lichens show the archaic union, a symbiosis between algae or cyanobacteria with fungi that is more than the sum of the parts. A new organism capable of colonizing the earth, of feeding, through *chelation*, directly from the stones and of delivering organic matter to the environment at the end of its life cycle and thus contributing to starting an ecological succession. A life gestation process.

◂ Water culture ▸

Many peoples worship water… they talk to it, call it with prayers and songs. Within the whirlpool of our 'western' ignorance we find glimpses of this awareness, in the holy water of the churches, in the baptismal font. Some baptize by immersing the initiate in rivers, lakes, the sea, in some water body. Since remote times in our history, there have been precious and rich ritualism associated with waters, as diverse

as humanity. We find them in the cultures of Andean, Quechua, Aymara, Hopi, Navajo, Huichol, Mapuche peoples, and without a doubt, in those of rooted peoples on other continents as well.

We have finally arrived! Culture, knowledge, and education are the keys to the survival and good living of humanity in the current biosphere. An environmental culture for action and for synergistic adaptation is essential. Education!

We urgently need to reverse the globalized 'modern' paradigm, the Neo-Darwinian pyramid. Deconstruct it. It can be done. And then we need to install a conscious paradigm based on the rules of the biospheric game, the operational guidelines of the biosphere. They are not many...

Perhaps the first is to know that **nature is, and always has been, first! Finding that nature comes first means that the waters come first since all life is based on water.** The care of waters and water bodies, of hydrological basins, and all that they contain, as well as of the seas and oceans, should be the compass that guides human development.

Science informs us that approximately 50 percent of the air's O_2 is emitted, exhaled by the flora, and the other 50 by marine photoplankton. Same with CO_2 sink capacity; half and half between terrestrial and marine photosynthetic organisms.

It is a matter of observing, of looking closely, and of listening to the truthful, more real history of life that vanguard evolutionary biologists and ecologists are telling us. It is also what rooted peoples have been telling us for millennia.

Human beings we must humbly put ourselves at the service of nature, of waters and all its residences. Starting with ourselves. Clearly, our mental and physical health depends one hundred percent on the state and integrity of what we call 'nature'; which is the majestic bioecological network with which we co-evolved.

The biosphere, 'nature', is what provides the air with 21% oxygen, neither more nor less. It is what provides water, food (mainly water), and atmospheric, climatic, and hydrological regulation, as well as the regulation of the pH and salinity of the seas, key for the development of marine life.

The Gaian system, which allows the planet to be perceived as a macroorganism, seeks —through complex systems of negative and positive feedback— to regulate and maintain processes so that the biosphere that exists now can last. Biospheric processes intimately involve the physical, chemical, and geological, and the living. The traces of life are in all this planet of which we are parts, from its deep entrails to the high and ethereal atmosphere.

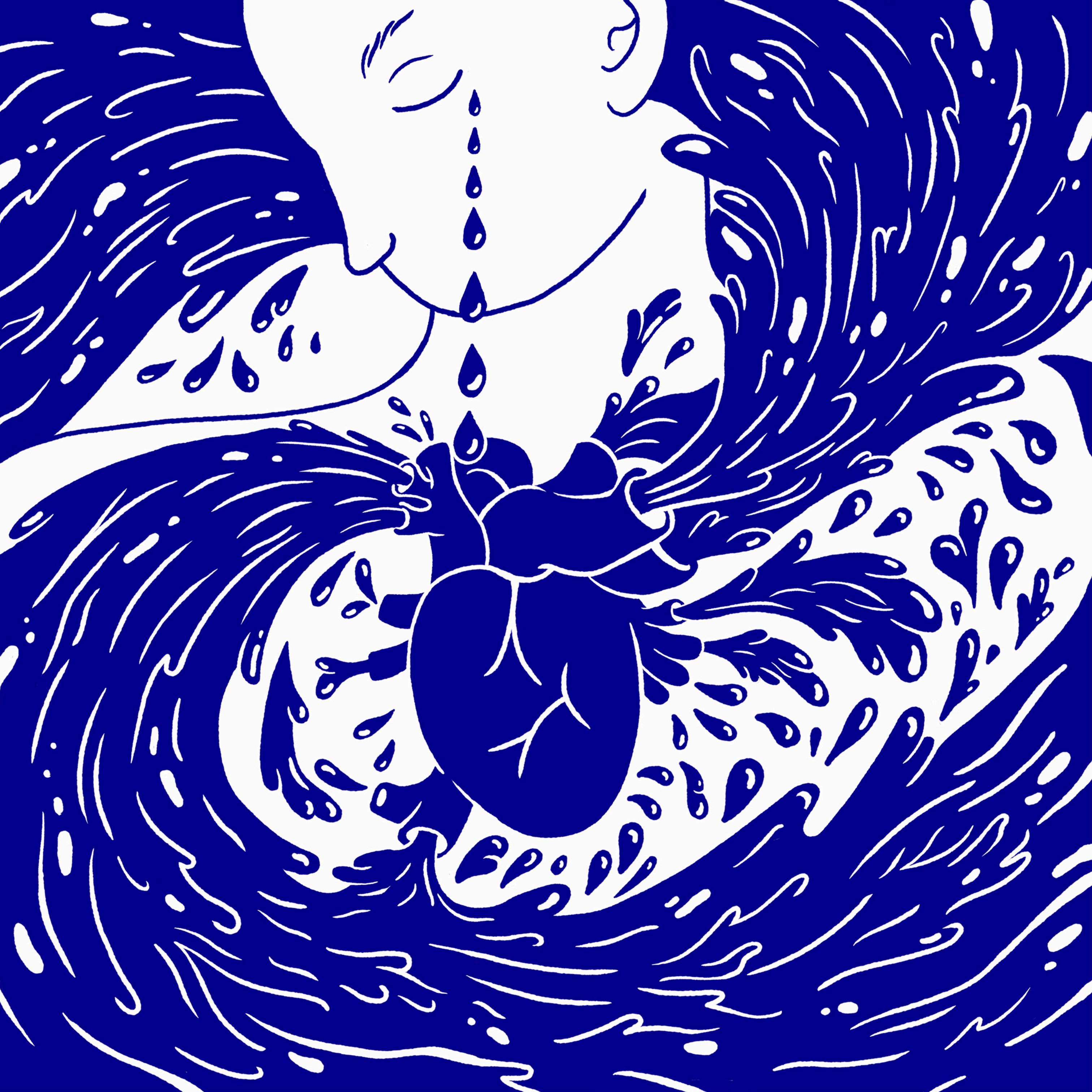
Wake up!

We urgently need to wake up, know… understand, and feel, to become synergistic agents for the current water-based biosphere of which we are part. Finally, in our case, that of humans, to be or not to be, having the capacity to give or take life, always has to do with love, empathy, knowledge, and wisdom. Or by lack of knowledge, unconsciousness. The sleep, illusory state that Buddhism posits as the human dilemma. The mysterious mental disconnection with the 'environment,' and with our own selves that human beings can fall into. We need to explore, study, assume, comply with, and consciously cultivate biospheric interconnections. Joyfully.

◂ Aramara's tears ▸

Finally, let us marvel at the fact that when sorrow overcomes us, water pours from our eyes. We cry. So, grief make us give away salty water by our eyes? Water gushes out through the windows of the soul? And, also, when we laugh out loud, our eyes sparkle watery…we 'cry with laughter.' Emotion moistens, makes water rise to the eyes and 'betrays' our feelings. Heart of water moving blood of water…

Blood plasma without blood cells or platelets is salty water, just like tears. Water of Aramara, the sea, mother of waters, crucible of life.



Colophon
The present book, Biosphere We Are Water, was printed during the summer of 2021 by the La Mano Ediciones in Santiago, Chile.

The cover was printed in Offset in blue ink, with details in holographic folia, in Duplex 270 grams.

The interior was printed by Risography using blue vegetable origin ink over Olin Rough 120 grams paper environmentally certified and acid free.

The magic of life on this Earth... The idea for this book and initial script arose on a plane heading to Puerto Montt, in the narrow seat, handwriting on a notebook propped up on the proverbial plastic tray, an apparently uninspiring environment. I was invited by Geute Conservación Sur to a conversation about "Water Culture" and I had not had time to jot down my ideas. Waters... A central theme in my life for decades. Central, maybe without realization, in the life of all humans and non-humans. Thus, what flowered with this book is an invitation to think and perceive and feel "outside of the box." To look back at waters, the matrix of the living, with eyes, mind, and heart refreshed.
With a child's innocence.

To reenchant ourselves with what we are: this water organized in a fantastic human form, which walks, talks, and sings; acts, opts, and can incline the balance between the biosphere's synergy and entropy, something by itself surprising. To rediscover that we live immersed in the magic and mystery of incomprehensibly complex and marvelous natural phenomena. It is so much what we do not know and do not understand. Good! Thus, the exploration and discovery are infinite... Silently beats our heart in our chest, pumping this rich red water in such an efficient manner that it reaches down to the last cell of our fingers and hair, without any conscious effort on our part... Sometimes, overwhelmed, we cry water, salty as the oceans, cradle of life.

With this book, beautifully and playfully illustrated, we invite you to gaze from different angles at water's magic and mystery. Those who gestated this work we have a humble aspiration: that after viewing and reading *Biosphere We Are Water*, your experience when you wash your face, swim in a river, or drink our -hopefully- crystalline blessed water of every day, will be different.

Magic and Mystery

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