Prometheus: The Passionate Soul of Scientific Reason

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There is a cliché according to which scientists should have nothing to do with passion; they should hold cold rigour as their ideal, which would be the phenomenal form of scientific objectivity. From this cliché emerges an image of a basically unfeeling scientist, who is keen on his speciality and is basically unable to communicate with other human beings. Is this idea reasonable? Do the masters who guided me in my scientific life correspond to this image? And do I recognise myself in it? When I was at my high-school I was deeply touched by Giovanbattista Vico's statement: "Human beings first feel, then become aware with a troubled and emotional soul, then they reflect with a pure mind" [1]. When I read this statement I remembered some beautiful July nights years before - I was twelve then - when I used to look at the sky from the terrace of my uncle's house. I did not look at stars as something other than me, I did not learn their names, which I ignore still: I simply tried to penetrate them, I was curious of them, I wanted to know how they lived, what their internal being was, I wanted to talk to them, I was curious of them, I felt that curiosity that is the pre-requisite of love. It was not, however, a possessive love; would I have felt disturbed if one million people besides me had simultaneously my same empathetic relationship with the same star?

And what would have happened if the star I was then in love with had exploded into a supernova and had thus disappeared? Nothing would have happened, I would have turned to another star; the cosmos is infinite and it never dies.

During these night journeys of my ego I was happy, troubled and touched. I had to go back to my rational self and call back the pure mind, as Vico suggested, but how could I ever have called it if I had not been happy for my troubled and emotional soul?

After many years I met a very important physicist: Herbert Fröhlich, whom I admired not only for his scientific discoveries, but also for his human greatness, for his refusal to serve institutional potentates, not only the notorious Hitlerian and Stalinist tyrannies but also the liberal democratic imperialisms of the Western societies which prevented him from accessing to the utmost scientific honours.

In a recent essay [2], Herbert Fröhlich's widow Fanchon Fröhlich remembers: "Philosophically he believes that there is an impersonal, non-individualistic path or *Tao* embedded both in the world and in the mind, and that at some deep level of insight

they coalesce.

Thus with respect to modern science, he regards the coalescence of the abstract mathematics done in the mind or a piece of paper with the elaborate experiments done in a laboratory as a source of wonder and mystery (in contrast to the reductionist who thinks this tautologically trivial). He has frequently said that in the creative process of thinking his mind goes out from his human frame and becomes the physical particle and field situation, feeling directly how they tend to behave, but using the techniques of mathematics both to capture this unknown physical situation and as an anchor so the mind can return to his own brain or everyday personality. Thereafter he solidifies what he has found during these mental voyages in calculations. As the *Tao Te Ching* says 'To understand emptiness, first you must become emptiness'. His deeper intention might be expressed as the wish to make matter conscious. This is based on a metaphysical belief that once matter has been understood, penetrated by mind, the matter is itself transformed. Such conviction exhibits parallels with Jung's ideas on Alchemy. He considers that the hard-edged external irony of logical positivism confuses the method of discovery in science with the subsequent method of exposition. This, methodologically very important, is the distinction between physics as written for publication, as if it were a logical discovery. One should distinguish between the beauty of the process – a mathematically guided *Einfühlung*, and the cool elegance of the subsequent mathematical formulation. It is this complete immersion in the trip of discovery, *Einfühlung*, which constitutes his special unending happiness.

Such tendency also manifests itself in his interest outside physics. He shared with his friend, Pauli, an interest in the Jungian concept of the collective unconscious."

The discovery process follows a totally different path to the results expounded during lectures or in textbooks. In the discovery process the scientist lends his own unconscious to the object of his research. As Giuseppe Vitiello states, the human brain exists and works because the ensemble of its oscillators resounds with a corresponding group of external oscillators which is exactly its double [3]. External oscillators assure dissipativity, which is an essential condition for life according to Prigogine and many others. As the human being's emotional nucleus is exactly the coherent fluctuation of his living substance, the emotional nucleus, that is passion, is the condition enabling the brain to work. It is therefore the pre-requisite for the development of science.

I have recently learn these concepts, but my boyish unconscious was already convinced of their truth and indeed it was already working with them. I thus chose to enroll in physics, in order to become a theoretical physicist, I decided to concentrate on the mysteries of physics, which I then identified with the world of elementary particles. All that happened in the Sixties.

Unfortunately my beginnings were not particularly happy. I was strongly disturbed by the coldness of the mathematical formalism to which the theory of physics was reduced; there was no trace left of the emotion of those July nights with the stars.

In those years my passion was devoted to the social and political struggles in which I actively took part and from which I understood that reality cannot be split into independent "atoms", the individuals, who only interact through reciprocal collision or the implementation of external forces. On the contrary, reality bases on the correlation of all its parts, which communicate through the common environment of which they are a part. I later learnt that that common environment is the "quantum vacuum".

Another reason for my feeling upset was the belief of many physicists who stated that quantum physics implied the impossibility of an objective understanding of reality, so that very important faculties such as intuition ranked second compared to mathematical formalism.

In the seventies I bumped into the works of Willhelm Reich's, an heretical thinker of the Twentieth Century, who was one of Freud's partners, who later broke away from his master's approach in order to undertake a study of the material bases of the psyche [4]; a living being, even more so if a human being, is not only a group of molecules interacting on the basis of chemical laws. On the contrary, it is an individual capable of global purpose-oriented behaviours. Through what kind of intermolecular dynamics does the purpose of the acts of living beings emerge? What specific intermolecular dynamics is the cause of my being sad or happy?

In 1975 I found a field that would keep my mind busy till the present day, which is the study of the emergence of the collective properties of matter and particularly of the living state. Some years later I met Herbert Fröhlich, who became my model. Meanwhile I started to interact with other colleagues with a different background who all aimed at the same targets: Giuseppe Vitiello, Silvia Doglia, Marziale Milani.

I first discovered that quantum physics was the right conceptual field to make my boyish dreams come true and that the disturbing elements I mentioned above did not belong to the conceptual basis of the theory, rather they were the product of the rough epistemology of some physicists and even more, of the prejudice about the fundamental role of the individual approach. Bell's well-known theorem (1964) summarises the incompatibility of the following three statements:

1. quantum physics is valid

2. an objective description of physical reality is possible

3. physical reality is a group of events localizable in space and time

One of the previous three statements has to be dropped.

Einstein dropped the first one. Indeed, in his later years he stated that quantum physics could not be the definite level of the development of theory. Bohr and most quantum physicists dropped the second statement, thus producing the well-known paradoxes. There remained the fascinating possibility of dropping the third statement, which was very tempting to one whom, like me, held communist views. An objective quantum description of reality, free from the slightest vein of subjectivism must necessarily include the existence of extended space domains in which the constituents revealed an in-phase connection, thus producing synchronical behaviours (i.e. unconnected to light speed), as stated by Jung in his dialogue with Pauli. We will come back to this point later. The possibility of these behaviours had already been anticipated by Walter Nernst [5] in 1916, who wondered what would happen if the originally unconnected quantum oscillations of atoms suddenly tuned in, thus producing a common oscillation of the whole ensemble of atoms; this common oscillation would provide the object with its unity and possibly with its purpose.

These concepts fascinated me and opened my eyes to a new world. Quantum physics had been distorted by some of its followers. I remembered Epicure's confession, which Karl Marx later quoted [6]: "Unholy people are not those who deny the existence of the gods of the populace, rather unholy people are those who endow gods with the feelings of the populace".

I thus came back to the origins of quantum physics and I studied Walter Nernst's approach [7], which seemed particularly enlightening. Nernst focused on the problem of the molar heat capacity of solids at a low temperature. Let us consider a body consisting in a definite number of atoms, for instance Avogadro's number. The molar heat capacity is the amount of heat needed to increase the temperature of a mole of matter by one degree (a mole is a set of atoms corresponding to Avogadro's number). Temperature is the average kinetic energy of atoms. Molar heat capacity must therefore correspond to a well-defined variation of the total kinetic energy. Say we are within a temperature interval which is below the lowest phase transition or structural variation of the body, so that its potential energy remains constant. The total amount of energy transferred to the body is changed into variation of the total kinetic energy of its atoms. As the heat amount of one degree corresponds to a definite amount of energy, the molar heat capacity of a solid at a low temperature must be constant and it does not depend on temperature. This statement coincides with the famous experimental law worked out by Dulong and Petit, which is valid for medium-low temperatures.

If, however, this law were accepted as valid at temperatures approaching and reaching absolute zero, thermodynamics would enter a crisis because entropy would be infinite. In order to analyse the possibility of this catastrophe Nernst examined the behaviour of molar heat capacity of solids at a low temperature and he found that they vanished when the temperature approached zero (third principle of thermodynamics).

The entropy crisis at low temperatures was thus avoided. However, classical mechanics entered a crisis. As a matter of fact, in order to increase temperature by one degree, the amount of energy required (molar heat capacity) decreased as temperature gradually approached zero. The molar heat capacities corresponded to the sum of all the energy flows coming from detectable sources (particle collisions, applied force fields). The fact that the "legal market" of energy provides an amount of energy which does not account for the increase of temperature by one degree may mean two things: either the atoms of the body could autonomously increase their kinetic energy (violation of the inertia principle) or there existed an "illegal" energy market which the body could revert to.

The former possibility was absurd and would upset all scientific tradition; the latter attracted my Neapolitan soul. Nernst too chose the latter explanation, and he concluded that not only the recognisable and identifiable physical bodies could be a source of energy and momentum, but also the vacuum could be. This reservoir of energy and momentum could be revealed when the other reservoir, the "thermal bath", gave a flow which was small enough; that happens for example at a low temperature. On the contrary, at a high temperature the energy flow from the vacuum was insignificant when compared to that of the "thermal bath".

The appearance of the vacuum as a physical agent broke a pillar of classical physics, that is the concept of the isolated body. No body could now be isolated: indeed, even if it could be kept away from the influence of other bodies, it could never be disconnected from the vacuum. Through the vacuum all bodies interacted and, since the arrival of a "wave" from the vacuum could not be predicted, each individual body was subject to unpredictable "quantum" fluctuations. It is not the interaction of the object with its observer that originates quantum fluctuations; rather it is its interaction with the vacuum.

The crisis of classical physics thus appears

at a low temperature. It is, however, a common belief that the crisis was revealed by the divergence to infinity of the function of spectral distribution of the radiation released by a black body when frequency tends to infinity or when the wavelength tends to zero (catastrophe of the ultraviolet).

Wien's law states that the function of spectral distribution depends on the radiation frequency and on the temperature of the source through their ratio. Consequently, the mathematical structure of the theory must allow to simulate the temperature limit tending to zero with the frequency limit tending to infinity. The ultraviolet catastrophe should thus be replaced by the catastrophe of cold.

The above intellectual path convinced me to consider "quantum" physics as the most important instrument to solve significant antinomies of the previous scientific tradition, such as that between matter and motion. Through the quantum fluctuations bodies are always in motion, so nature does not reveal any "horror vacui", on the contrary it reveals a form of "horror quietis" thanks to the vacuum as another important physicist, Giuliano Preparata, once stated. I had the chance to meet him and he soon became both a friend and a partner to me. His book "Introduction to a Realistic Quantum Physics" published posthumously in 2002 [8], sheds some precious light on the conceptual scheme of quantum physics. His statements about the nature of the quantum vacuum are also enlightening [9].

The separation between matter and motion, the expulsion of the motion from the concept of matter leads up to a conception of matter as an inert passive entity, incapable of development when free from external forces, whose nature and dynamics are extrinsic to the nature of the matter which suffers their action. In its conceptual structure classical physics mirrors the dualism between the machine and the project of its designer, between hardware and software, between two distinct entities in which the passive element, the product, owes its existence and its mechanics to the creator's project. The generalization of this separation within the whole universe leads up to the introduction of some demiurge's "intelligent project" as an axiom explaining the motion of nature. The separation between matter and motion is the common ground where the positivist scientist and the theologian objectively cooperate: their common aim would be to free matter from its compulsion to motion so that motion becomes an external entity without which matter would remain inert.

This was indeed the programme on which the first modern scientific institution, the Royal Society, rested. It was founded in the 17th century and was one of the ideological pillars of the English monarchy, which had been restored after Cromwell's Revolution. The other pillar was the Church of England.

Each pillar stated that the divine, that is the factor of motion in matter, was not inherent in matter. This statement was against the belief held by the great magic Renaissance tradition [10], whose heroes were Paracelsus, Giordano Bruno, Böhme and Campanella. In this Renaissance tradition matter was considered to be active, as described by Epicure. Marx stressed the antagonism between the Epicurean and the Democritean conception, in which matter is passive, as in classical physics. The old clerical powers and the new power of the victorious - therefore no longer revolutionary - bourgeoisie, united against this vision of matter as an entity which is capable of autonomous motion.

In their opinion the principle of activity and motion cannot be inherent in matter, which would otherwise organise itself autonomously. As a matter of fact, such self-organisation has indeed taken place throughout

the history of natural evolution. Thus matter would no longer accept the idea that it depends on God, embodied on earth by the Church, the State, by capital, the market, by experts, health authorities, scientific authorities, in other words by all slaves of power, with exclusion of the material body which must evolve.

At the beginning of the 20th century, on the eve of the great revolutions which shook the world and were eventually defeated, the evolution of scientific thought led to quantum physics whose concept of the oscillations of the vacuum put motion back to matter and re-establishes the possibility of a new connection between rigorous science and the great magic Renaissance tradition, which had been interrupted in the 17th century by the holy alliance between secular science and clerical theology.

I became aware of this conceptual background in the Seventies and Eighties so that my youthful passion, which had till then found no outlet in science, could finally merge with scientific reason, thus nourishing such a myth as Prometheus' in my enthusiastic mind. Prometheus gave mankind the fire, which had so far been kept by the gods: I could, together with a whole movement of thought linked to such names as Wilhelm Reich, Herbert Fröhlich, Giuliano Preparata and the Japanese physicist Hiroomi Umezawa [11], my friend Vitiello and many other younger scientists, take part in the restoration of the principle of motion and self-organisation to matter, which had always followed it.

The portion of reality in which self-organisation produces its strongest effects is living matter, where purpose, psyche and consciousness emerges from the molecular level. I can pick up a stone and a cat and drop them from the same height. They take exactly the same time to reach the ground, which proves the basic unity of matter. However, after the fall the stone remains where it is, whereas the cat runs away or rather attacks me. The cat thus belongs to a more advanced level of matter than the stone.

What is the difference between the cat's molecules and the ones of the stone? If we analyse the chemical structure of animate and inanimate matter, we discover a remarkable difference. In the latter, chemical reactions take place after random collisions between molecules consequent to their diffusive motion; in this condition molecules are polygamous since the likelihood and speed of reaction depend only on the law of mass action. That is why in an industrial chemical reactor, together with the "useful" encounters between molecules which lead to the production of wished-for molecular species, also produces a great number of "unintended" encounters leading to unwished-for molecular species, the so-called "industrial chemical waste", so far an inevitable by-product of any chemical industry.

In the biological chemical reactor, instead, molecules discover monogamy, in other words they meet and react on the basis of codes [12] (of which the genetic code is an example); molecule A only meets molecule B and not molecules C, D, E, F. Moreover, the reaction rate is far higher than in inanimate matter. It is as if in biochemistry there existed selective intermolecular forces, acting only between specific pairs of molecular species within a given environmental condition which characterises a given biological cycle (this environmental condition is almost always the presence of a specific enzyme). These forces must also have a wide range of action so that the reacting molecules may - even at a great distance - recognise and attract each other.

This peculiarity of biochemistry led a lot of physicists - Fröhlich was one of them [13] - to feature a role for the electromagnetic field

as an agent capable of connecting molecules from a great distance. In order to preserve the unity of the organism and its homeostasis, it is important that the chemical events taking place in different parts of the organism may be instantaneously connected to each other, thus avoiding the time-consuming mechanism of diffusive processes.

An electromagnetic connection between bio-molecules therefore seems to be an attractive possibility. However, how can we account for its origin?

Living matter shows another peculiarity: water is its most important constituent. In an adult body it represents 70% of its weight. However, if we consider that the mass of the water molecule is small in comparison to the much greater mass of other bio-molecules, we can conclude that over 99% of all molecules in our body are molecules of water. It should be noted that to a chemist the number of molecules is more remarkable than their mass. It follows that living matter is a very diluted water solution, which however radically changes its properties because of small variations of the water amount. A loss of some litres of water is sufficient to cause dehydration symptoms. On the contrary, a much diluted water solution does not considerably change its properties if the solvent quantity varies by some per-cent units. Consequently, the role of water in living matter cannot be that of a mere solvent. It is known that for each bio-molecule there exists a specific hydration threshold under which the bio-molecule loses its nature and thus forfeits its capacity to be part of a living process.

There is finally an energetic problem. If we understand the living organism in terms of a thermal motor, its performance cannot exceed Carnot's limit, that is the ratio between the temperature variation between the extremes of the interval in which the living organism works and the absolute temperature of the warmest point. In human beings the numerator is known not to exceed a few degrees, whereas the denominator is 310° Kelvin, which is 37° C. Consequently, the yield of the hypothetical thermal motor that corresponds to the living organism does not exceed 1%: it is a rather ineffective engine.

The energetic yield measured by bio-electrochemists is much higher. Bockris states that in the processes on cell membranes the energy performance amounts to 65% / 70%. The living organism is not a thermal motor: the energy exchanges in it cannot mainly take place in the form of heat, rather as free energy.

Therefore the protagonists of the biological process cannot be the single independent molecules, but mesoscopic collectives characterised by millions of molecules acting in unison in wide regions of the space for long intervals. These collectives made Nernst's dream come true in 1916: that molecular constituents may tune their individual oscillations in a single collective oscillation, thus transforming a chaotic crowd into a corps de ballet. In physicists' jargon this property consisting in an in-phase set of many molecules is termed "coherence". The number of molecules is necessarily indefinite on account of the principle of uncertainty. The mesoscopic collectives of microscopic constituents oscillating in unison are called "coherence domains".

In 1968 Fröhlich suggested that the dynamics of the living organism is based on the coherence of its molecular constituents. How can this vision be connected to the results of modern molecular biology, which managed to determine the sequence of chemical reactions that correspond to the different biological events? These results are based on experience and are basically correct. However, they must obviously be integrated into the dynamic law that governs bio-molecular motion and selects the "right" encounters,

thus avoiding inappropriate connections. In the course of this process the dynamic law generates the biological purpose without resorting to improbable extrinsic "intelligent projects".

The quantum theory seems to be the most important instrument to develop this program. The first result obtained along this line is the following theorem proven by Giuliano Preparata [14]. A set of N microscopic constituents, capable of assuming different individual configurations, enters a coherent state characterised by the common fluctuation of all constituents between the configuration of the least energy and another configuration marked by an excitation energy E, when its density exceeds a critical threshold and the temperature is below a critical value. The oscillation of the constituents is tuned with the oscillation of a coherent electromagnetic field trapped in the same coherence domain. The domain dimension equals the wavelength of the electromagnetic mode resonating with the excitation energy E of the constituents. In the coherent state the frequency of the electromagnetic mode, being necessarily the same as the frequency of the molecular oscillations, is lower than the frequency of the same mode in the vacuum. As a consequence of a well-known mechanism in the quantum theory of fields, the photon mass becomes an imaginary number, in other words light loses its ability to propagate and remains trapped within the coherence domain, thus driving its coherent oscillation. In the transition from the initial non-coherent state to the coherent state the system releases energy to the thermal bath, which is only possible if the system is open. The second principle of thermodynamics is satisfied since the entropy decrease connected to the setting in of coherence entails a release of energy towards the outside. This transition from disorder to order is spontaneous in that it automatically takes place through the network of the quantum oscillations of the vacuum with the oscillations of the single microscopic constituents, as soon as density and temperature step into the right intervals.

The coherent oscillations of the molecules which are in-phase with the electromagnetic field interlock with the thermal fluctuations of the molecules, which may push some members of the coherent process out of phase when their amplitude Kt is comparable to the "energy gap", that is the difference between the energy of the coherent and non-coherent state. A competition is thus generated between the attraction produced by the coherent correlation among the constituents (the so-called "yin" in Tao Chinese philosophy, which was so dear to Fröhlich) and the disorder produced by the thermal fluctuations (the "yang" expression used in Tao Chinese philosophy). Like in Landau's model of superfluid liquid helium, the whole ensemble of microscopic constituents falls into a coherent and a non-coherent fraction, whose relative value depends on temperature. Over a certain critical temperature, coherence disappears and the whole system becomes non-coherent.

Vitiello and I [15] analysed how coherence emerges from the interaction of the microscopic constituents with the quantum vacuum. The starting point is the property of the invariance of the Lagrangian of the system (which is the mathematical expression from which the equations of motion are derived), with respect to arbitrary variations of the oscillation phase of the matter field, that is the set of the microscopic constituents. This property accounts for the impossibility to directly observe the quantum fluctuations in space and in time. The mathematical structure of the quantum theory of the fields requires this invariance to imply the existence of "gauge fields" coupled with the matter field. Those gauge fields are capable of diluting away the fluctuations of the constituents in space and time. It is the

gauge field that fills the vacuum and mutually connects the microscopic constituents. Within the atom and molecule scale, the gauge field is the so called vector potential of the electromagnetic field. To implement the necessary invariance for arbitrary phase transformations of the matter field, the electromagnetic potential must be subject to a particular mathematical property, the gauge invariance. The two invariances are strictly interconnected. The conceptual scheme of the field theory shows that under Preparata's density and temperature conditions the phase of the matter field becomes a well-defined function in space and time and the electromagnetic potential consequently "chooses" a well- defined gauge, which gives a mass to its quantum, the photon. In other words, disordered phase fluctuations are thus connected to the non-coherent electromagnetic fields. On the contrary, the appearance of correlations in the constituent phase is the consequence of a coherent electromagnetic potential. These correlations are kept up by a messenger that spreads within the coherence domain with the phase speed, which is known to be free to exceed light speed and does not have a superior limit. For this reason within the coherence domain synchronic events may take place; physics can thus meet Jung's requirement as stated in his dialogue with Pauli.

The appearance of coherence sheds a new light on the relations between the vacuum and the microscopic constituents of matter as Nernst outlined in 1916. The material system is disordered; we could even say "gaseous" (the expression "gas" is indeed the contraction of the word "chaos") when the gauge field - that is the dynamic element of the vacuum - is not coherent. The coherence of the vacuum translates into the coherence of matter. This conclusion allows a connection between quantum physics and the results reached by ecology, psychodynamics and by social sciences in which individual behaviour is governed by super-individual dynamic structures capable of evolving in time and of shaping history. On the one hand, the Lagrangian motion equations are reversible in time and they do not account for the appearance of a time arrow. On the other hand, the dynamic evolution of the quantum vacuum is irreversible; it breaks up the symmetry of the Lagrangian and introduces history in nature.

On the basis of these acquisitions on coherence some light has been shed on the properties of non-gaseous matter, of condensed matter (liquids and solids) including the dynamic mechanism of phase transitions, which are the discontinuous mutations in the aggregation state of matter, which take place in certain termodynamic conditions.

In order to understand living matter, it is important to consider the case of liquid water [16]. The coherence theorem shows that in a liquid state, water molecules produce coherence domains whose size amounts to one tenth of a micron and in which molecules fluctuate between their configurations of least energy, in which electrons are strongly bound, and a configuration where an electron is very weakly bound, where indeed it is almost free. This property attaches great importance to liquid water. As a matter of fact, coherent water can be an electron donor, which means that water is a chemically reducing species. On the contrary, non-coherent water cannot donate electrons, it may only receive them, which makes it a chemically oxidant species. When it is possible to separate the coherent fraction from the non-coherent one, as happens to the interface with hydrophilous surfaces, a redox battery is produced whose power may reach the volt. The quasi-free electron plasma in the coherence domain of water may be excited by producing cold vortices since the electrons make up a coherent system and consequently their excitation, below the threshold indicated by the "energy

gap", is a collective one.

The cold vortices cannot undergo a thermal decay so that the average life of these excited levels of the coherence domain can last long. The only possibility of a decay of these excited states is that of a chemical decay in which the excitation energy of the coherence domain, which takes the form of an excited mode of the electromagnetic field trapped in the coherence domain, is resonantly transmitted to a specific molecule capable of oscillating on the same frequency of the excited mode.

The following situation is thus looming: the coherence domain of water gathers any kind of energy from the environment, ranging from thermal noise to sunlight, incorporates and stores it as coherent electromagnetic energy. The sum of the excitations is made possible by the length of the average lives of the excited levels of the coherence domains and by the presence of the earth's magnetic field which lines up the axes of the cold vortices of the electrons. When the stored energy corresponds to a frequency of the electromagnetic field resonating with the oscillation frequency of specific molecules, the latter are attracted and chemically activated by the release of the excitement energy. Water thus becomes the most important enzyme, as Vladimir Voeikov [17], a Russian biologist, pointed out. The coherence domains of water may thus have an internal structure of coherent configurations, and as Preparata's theorem shows, they can produce a coherent set of coherence domains, a kind of second-degree super-coherence, which is in line for the role of organiser of living matter. Such super-coherence would be that "vital force" which such pioneers as Driesch, Gurwitsch, Fröhlich, Popp, and others have dreamt of and which the superficial mechanistic paradigm had so far confined within the irrational. Should the irrational not be the main investigation field of the followers of the goddess Reason, whose saying is: "Damn, I will explain you!"? Unfortunately, the irrational prejudice sometimes blinds exactly the followers of reason, to whom the name "goddess" is dearer than the name "Reason".

Along this path, we have come to face some fascinating phenomena over the last few years: not only the origin of life, also the cold fusion of atomic nuclei. In this research I made new friends and accomplices in "scientific crimes", such as Martin Fleischmann and Antonella de Ninno, who are involved not only in the cold fusion project, also in the whole coherence program where other pioneers such as Fritz Popp, Vladimir Voeikov, Larissa Brizhik and many others are at work. These concepts often come up against the inability of minds trained by absolute specialization to detect the "unexpected connections" between apparently unrelated facts, which Poincare describes as the basis of scientific progress. There is a Chinese proverb which goes: "Those who climb down a well in order to see the sky, cannot see much!" The acquisition of the title of "expert", which is an essential qualification within the scientific community, requires climbing down a deep well. The new knowledge has to cope with many problems posed by the established scientific world.

The only answer we can give is what Prometheus said to Hermes, Zeus's messenger: "I swear I would never exchange my miserable fate with your slavery. I deem it a far better lot to be chained to this rock than be Jupiter's faithful messenger".

In memory of Dr. Del Giudice.

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