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POPULARIZATION OF KNOWLEDGE – NEW EDUCATIONAL AND SOCIAL IMPLICATIONS

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Paradigmatic crisis and biomedical research

Introduction

This article aims to question for the first time a contemporary scientific theory: intercellular communication which will be studied through experimental sciences, as well as human and social sciences.

Biomedical research as a whole possesses a common denominator: it is based on a physiological-chemical-physics conception of the living. Cellular and molecular physiology teaches us that our cells, fundamental bricks of the living, hold an intercellular communication with a chemical physics nature, based on a lock and key model. Several chemical messengers, such as hormones or neurotransmitters, are the support of a cellular information and signals.

The chemical-physics conception of the living first appeared in the 1900's after the cell theory was accepted by one of the neuroscience founders: Santiago Ramon Cajal, a clinical pathologist. He first put forward the existence of a chemical messenger between neurons and thus, an intercellular communication.

If one analyses every scientific publication on the international website "Pubmed", it appears that in 1923, a first set of data feebly suggested another form of intercellular communication. In the 70's, the scientific literature was increasing on that subject, mentioning another form of intercellular communication based on ultra-weak electromagnetic signals. From 1970 to 2015, several works have been led by different research teams from different countries, who put forward the same data. In 2009, Luc Montagnier, Nobel prize winner, published for the first time data on the emission of a genetic electromagnetic information coming from the DNA of a prokaryote.

Yet, the actual paradigm and the chemical physics conception established do not refer to any intercellular communication of an electromagnetic nature. It seems that the whole of these works, as well as those of professor Montagnier, are not integrated to the actual conception. Nonetheless, a paradigm was defined by Thomas Kuhn, a science philosopher, as the acceptance of a unifying theory within

a sociological system of faith in the scientific community. Can we thus speak of a crisis of the actual paradigm?

That is what will be tackled in this paper. First, we will put forward what really is a paradigmatic change according to the sciences philosophy. Then, we will present the establishment of the actual paradigm and the new experimental results which underline an unknown phenomenon and the theories that came along with it. The analysis of these data will allow us to determine whether or not a crisis of the actual paradigm is in progress.

Discontinuities and indicators of a scientific crisis

Scientific discontinuities

There are several scientific revolutions that can be named: rationality brought to the forefront by the pre-Socratic Greeks; the Copernican Revolution and the abandonment of geocentrism; Darwinism's introduction; relativism; the discovery of the DNA's structure; the Quantum's theory and the Special Relativity's theory.

Three authors disagree with the conception according to which science is continuously developing thanks to successive discoveries that do not call into question its founding principles.

Indeed, Bachelard, opposed to the point of view that science is continuously developed by slowly integrating new knowledge, showed that a new theory stems from an epistemological rupture: it is a radical innovation and cannot be issued from previous theories. The epistemological act that gives birth to a new theory is the synthesis of a theory rewrote and an epistemological rupture. To rewrite a theory, one first needs to mentally reorganise and then reorganise the knowledge that is to be explained in the new theory, which will be different than in the previous theory. The epistemological theory is the outcome of this rewriting. This rupture results from a constant desire to destroy existing theories in order to create better, more abstract and purer theories. It implies to look at the reality and find what contradicts the former knowledge, for the human spirit is lazy.

Furthermore, according to Popper, a scientific theory is a hypothesis which will be one day refuted and replaced by another one. It thus cannot be declared as true. This affirmation comes out of the fact that he categorically refused induction which cannot be logically justified. A hypothesis or theory is refutable if it is possible to imagine an observation wording that can contradict it. For Popper, refutability is the criterion that differentiates science from non-science. In the approach of the science evolution, Popper granted a lot of importance to refutation because: 1) as it is not possible to justify a theory's truth, the latter is thus merely a work hypothesis, an adapted construction to our observations for the moment; 2) It is almost sure, that this new theory will be refuted one day thanks to new observations which will end up with the elaboration of a new theory.

Finally, Kuhn explained that the evolution of science is due to the different revolutions which give weight to the attitudes and beliefs of the scientists themselves. In most of the fields, there is a sort of prehistory in the considered discipline: several rival schools of thoughts mingle with each other. The reason for this is that in the absence of a theoretical framework, it is impossible for all the researchers to rely on one and only conception about the kind of phenomena they are studying. According to Kuhn, a discipline is really considered as science when all the scientists possess the same conception on it and agree on the problematics or refute together the possible answers. This presumed knowledge constitutes the paradigm shared by scientists. Thus, the Newtonian Mechanics and Einstein's Special Relativity are examples of this paradigm.

Indicators of a scientific crisis

Besides, Kuhn developed a concise analyse on the existence of a scientific crisis and the indicators that allow to identify it in his publication "The structure of the scientific revolutions". According to him, the scientific revolution and crisis ensue from an anomaly. The latter occurs when an experimentation that tries to precise something else is led or when there is a disagreement with what the paradigm predicted. It takes the shape of an apparition of an unknown phenomenon to the paradigm. An accumulation of anomalies or one single anomaly that touches the paradigm's founding principles lead to a paradigm crisis: Scientists discover they cannot claim their knowledge presumption. As this crisis cannot last for long, a new paradigm takes place and gives an explanation to the anomaly detected before. Its adoption by the scientific community states of its new stage of "normal science".

Indeed, in Kuhn's opinion, the path from a theory to another is due to a causal mechanism of a sociologic and psychologic nature, not a critical examination.

From this extract of Kuhn's publication, the indicators that allow to identify a scientific crisis amongst a paradigm are the following:

Scientists behave differently towards existing paradigms when there is an anomaly or a crisis and their researches' nature change consequently. The proliferation of rival variations of the paradigm, the need to try anything, the expression of a clear dissatisfaction, the use of philosophy and discussions based on theoretical grounds are the signs and symptoms of the path from normal research to extraordinary research.

- Indicator 1: The proliferation of rival variations of the paradigm,
- Indicator 2: The expression of a clear dissatisfaction,
- Indicator 3: The need to try "anything",
- Indicator 4: The use of philosophy and discussions based on theoretical grounds.

These four main indicators will be used for our analysis throughout the rest of this publication.

Evolution of the scientific knowledge on the intercellular communication: from the actual paradigm to the new experimental discoveries

The actual paradigm

The cell theory (Texier-Vidal, 2011) was born thanks to the invention of the microscope at the end of the 17th century, however, its elaboration took more than a century. During this period, it benefitted from technical progress and the accumulation of microscopic images. This theory is the result of a remarkable effort of abstraction which led from the extreme diversity of images to the joint concept of a round cell that splits into two daughter cells etc. This abstract concept was not well received and gave rise to a persistent controversy and famous among Bichat's school, Auguste Comte's school and the Vitalists. One can notice that the scientists who have expressed this theory – to which their names are stuck to, such as Schleiden, Schwan and Virchow – have not all been discoverers of new morphological data. However, after several discussions, they were declared as the source of the best definition on cell, such as formulated by Schultz in 1861: "a small mass of protoplasm in which there is a nucleus". In that, it is at the origin of a new subject born in the middle of the 20th century: Cellular Biology. The Natural Sciences thus aim to study the mechanisms of chemical physics and physiologic that sustain life. This is the prolific attitude carried until now. Fifty years have gone by between the establishment of the cellular theory and the neuron doctrine, initially discovered by Cajal. The neuron doctrine (Texier-Vidal, 2011) can be considered as an answer to the general problem of the intercellular communication. The intercellular communication's existence and mechanisms were highlighted much later for most of the specialised cellular. However, the mechanisms involved were totally different as they possessed a humoral and paracrine nature rather than a morphologic nature. Yet, the cellular theory marks a significant step and has never been put into question since the scientists got used to it.

The first person who supposed that a chemical messenger intervened between neurons and thus that an intercellular communication existed was the clinical pathologist Santiago Ramon y Cajal in 1888 (Ramon y Cajal, 1906), one of the founding fathers of neurosciences. He observed there was a space between neurons. From there, he suggested that a chemical communication existed between neurons: this was proved a quarter of a century later. The physiologist Claude Bernard (Texier-Vidal, 2011) also studied the curare's mode of action in the second half of the 19th century. His pupil later showed that the curare stopped the communication between nerves and muscles. In 1914, another physiologist, Dale (Cheymol, 1975), noticed that a chemical substance named the acetylcholine produced similar actions to the heart (reduction of the heart beat), though the effects did not last long. He thus concluded that the Ach reproduced the parasympathetic nerves' action and that it should quickly be inactivated or destroyed. The works realised by Dale then by Loewi (Cheymol, 1975) in 1921 showed that the nervous transmission implied

the release of Ach in the pre-sympathetic nerve endings, and the interaction with receptors in the muscles' post synaptic membrane.

The works on neurotransmitters, the molecules released by the neurons in the synapses, stimulated another area of research. Indeed, if there is a chemical messenger coming from one side, there must be a receiver from the other side. In 1894, Emil Fisher first spoke about the lock and key theory which was then developed around the receiver by Dale in 1959. Nachmansohn then applied it to the Ach receivers (Cay-Rudiger, 2003).

As for the hormonal communication, it seems that the origin of endocrinology was discovered around 1849 thanks to the experiences of castration led on cockerels by Berthold who proved the endocrine role of the testicles (Klein, 1968). In 1889, the French neurologist Charles-Edouard Brown-Séquard initiated, without identifying it though, the first hormonal therapy (Klein, 1968). The discovery and the identification as such of the first hormone were linked to the observations made in 1895 by the renowned Russian physiologist Ivan Petrovitch Pavlov (Gerard, 2000). He suggested the existence of a secreting reflex initiated by the acidity of the chyme. To him, there was no doubt that this reflex was strictly nervous. However, in 1902, experiences led by William Mortlock Bayliss and Ernest Henry Starling, two British physiologists, showed on the contrary the existence of a substance secreted by the intestinal mucous and effective through blood on the pancreas (Bayliss, Starling, 1902). Bayliss and Starling named it "secretin". The term hormone was first introduced in 1905 by Starling.

The intercellular communication, as a scientific theory and paradigm in the 1900, is thus characterised through chemical physics mechanisms like the lock and key which involve chemical messengers such as neurotransmitters or hormones that have an impact on specialised receiver cells. The latter, once activated, allow the cell to enter a stream of transduction of the intercellular signal. This intercellular signs may, for example, induce activations or inhibitions of membrane proteins (such as canals) or of synthesis proteins and allow in any case the continuation of an initiated cellular communication.

New experimental discoveries

- *The proliferation of rival variations of the actual paradigm: Indicator 1*

More than 400 publications (Cifra et al., 2013) relate these new discoveries made since 1920. We will only present a few of them in this paper – the most representative.

From 1923, the embryologist Alexander Gurwitsh published in *Archiv für Entwicklungsmechanik der Organismen* and cast light for the first time on an ultra--weak emission of photons by living tissues that is called 'mitosic beam', which implies it has a stimulating effect on cell division.

In the 70's, Fritz-Albert Popp proved the existence of biophotons, coming from living tissues. Gurwitsh then suggested an operating theory which explained that

the biophotons could be involved in different functions of the cell, such as mitosis and that they even could be produced and detected by the cell's nucleus DNA.

In 1980 and 1981, Kaznacheev published in *Bulletin of Experimental Biology and Medicine* and *Nauka*, and highlighted the detection of a eukaryote intercellular communication created thanks to biophotons radiations.

Experimental results carried on and in 1984, Fritz-Albert Popp published in *Cell Biochemistry and Biophysics* and brought to light DNA as an important source of emission of photons because DNA's conformational change via ethidium bromide in vivo clearly showed changes in photonic emissions by cells. He thought that DNA was assimilated to an excimer laser. DNA is thus, like a laser, a "source" and "storage area" of photons. He pursued his studies and published it in 1992 in *Experientia* and explained that the photonic emissions by cells are a non-linear answer regarding external disturbances (he noticed chaos, fractal behaviour and non-equilibrium phase change). In 1997, he showed, thanks to his publication in *Science in China Series C Life Sciences*, that intact chicken's brains produce a higher level of photons intensity than damaged brains or that this level of intensity varies according to its development stage or freshness of the isolated brains. He suggested that the biophotons emission by living cells was due to the interaction between internal and external fields right next to the tissue.

These works were carried on and published in 2003 in *Indian Journal of Experimental Biology* and dealt with the human body.

The data showed that the photons emissions varied depending on the person's health and enabled to detect the regulating functions of the body: he suggested it as a new non-invasive tool for medical diagnosis.

In the meantime, in 2003, Beloussov and his co-workers published in *Russian Journal of Developmental Biology* and in *Indian Journal of Experimental Biology* as well. They presented their works which, thanks to a study on embryos and fish eggs, highlighted that the photonic beam produced by the embryos is actually a carrier of genetic information received and incorporated by the receiver egg without any chemical modification of the genome.

Moreover, in 2008, Chang also published in *Indian Journal of Experimental Biology* and carried out a study on the physical properties of the biophotons and their biological functions on fish. His data were in accordance with Popp or Gurwitsh's former propositions and he stated that the biophotons could indeed play a key role in the DNA's functioning, including the DNA replication process, the proteins synthesis, the cellular signs, the oxidative phosphorylation and photosynthesis.

In 2009, Luc Montagnier (Nobel Prize Winner of Physiology or Medicine in 2008) published in *Interdisciplinary Sciences*. He revealed for the first time that a bacterial prokaryote's DNA produces a small electromagnetic signal and, above all, that this signal carries out the sequential genetic information of the DNA. Indeed, a bacterial DNA is 98% identical to the initial DNA reproduced by PCR solely with the presence of the electromagnetic signal carried out by the initial DNA, elementary bricks and the polymerase Taq without any template strand DNA.

These data could be similar to former experiences but brought an additional fact: the DNA molecule really carries out an electromagnetic signal as suggested by Popp and Gurwitsh but this electromagnetic signal also conveys an information: the sequential genetic information.

Since these experimental results, other research teams have led and reiterated Kaznacheev's controversial experience of 1981 – such as Felds who published in 2009 in *Plos One* – and confirmed his results by using eukaryote cells.

In 2011, Rossi and his co-workers published in *Seminars in Cancer Biology* and repeated once more Kaznacheev's 1981 experience on eukaryote cancerous cells and showed that they deliver cancerisation information at distance to non-immortal cells while electromagnetic radiations are transmitted between two cellular cultures.

- *The expression of a clear dissatisfaction/controversy: Indicator 2*

Skepticisms came along from 1923 as Gurwitsh's results were not immediately reproducible. The explanation given by his detractors was that there was a rare process of oxidation on radicals.

Kaznacheev's controversial results in 1980–1981 were declared as artefacts. Indeed, owing to the difficulties encountered to isolate the biophotons' effects among the molecules numerous interactions, it is not possible to establish a verifiable theory. Furthermore, another objection is put forward: most of the organisms are immersed in light which intensity interferes with the biophotons' ultra-weak emission. This is why any communication is impossible.

This is the reason why the scientific community is constantly cautious towards all these experimental results that do not seem to be believable as they are not entirely explained nor based on a genuine theory, and are in disagreement with the actual scientific theories.

Montagnier's experience in 2009 did not reach out the French scientific community and the institutional authorities do not wish to finance the Nobel Prize Winner's researches for now. As a result, he moved to China to create his multidisciplinary laboratory there and pursue his researches abroad.

However, the controversies seem to continue but differently. For instance, Cifra's team and co-workers published in 2011 in *Progress in Biophysics and Mollecular Biology* and in 2013 in *Cell Communication and Signaling* an abstract on this possible new form of intercellular communication, the accumulation of scientific data in this area, and questioned this new way of signals. They concluded that, in theory, cellular signals via electromagnetic waves are possible, but they are limited either by specific biological events, or they require physical mechanisms that cannot be applied to biology for now, or these mechanisms are still unknown.

In 2014, Prasad and his collaborators published in *Journal of Photochemistry and Photobiology Series B* about the new perspectives in cellular communication and the possible role of a feeble emission of photons.

- *The need to try "anything": Indicator 3*

All the experiences led in order to highlight this anomaly have been orientated in different directions; the most original of all is given by the works of the Nobel Prize Winner Montagnier.

Indeed, Fritz-Albert Popp revealed the existence of biophotons issued from living tissues by using **photomultiplier tubes** that allowed him to detect these biophotons.

Then, the use of a **chemical agent**, ethidium bromide in vivo, showed a change in the photonic emission by the cells because of a conformational change of DNA by the ethidium bromide.

Studies on the human body were led by Popp and the experiences realised were executed in the dark thanks to a **photon sensor** on more than 200 people. This suggested it was possible to use a non-invasive tool.

Batches of eukaryote cells (such as cancerous ones) were studied in **culture dish** and put forward the exchange of information on remote cancerisation of non-immortal cells while electromagnetic radiations are transmitted between two cellular cultures.

Finally, the duplication of a bacterial DNA 98% identical to the initial DNA is reproduced thanks to a polymerase method of chain reaction called PCR, solely with the presence of the electromagnetic signal carried out by the initial DNA, elementary bricks and the polymerase Taq without any template strand DNA.

- *The use of philosophy and discussions based on theoretical grounds: Indicator 4*

Some works have been written since Gurwitsh in 1923 to give theoretical explanations to the results observed. A historical background of his works has been gathered later on in 1988 in *Experientia*.

In the 1970/1980's, Popp continued to write theoretical propositions based on a unique interpretation: DNA produces and receives electromagnetic waves that are bearing genetic information.

Yet, one of the first detailed and complete theories on that topic dates back to 1981 and was proposed by Emile Pinel, a medical physicist, who is at the origin of white cell biometrics. It seemed interesting to quote him as Pinel, even though he was criticised, suggested in 1981 that a cell's nucleus is a computer that possesses an electromagnetic transmission field thanks to energetic levels that it updates directly in line with the DNA: 28 years before Montagnier proved there was an emission of electromagnetic information from DNA in 2009, which was simultaneous to Popp's new experimental discoveries.

Emile Pinel, physical medicine doctor, was one of the first to attempt to model a living cell's functioning in 1981 in "Physique de la cellule vivante"; his suggestions did not scientifically prove the biological phenomena observed. He presented his theory to the French Academy of Sciences and to the rest of the scientific community

who were fearful to this theory, that was not experimentally explored and well criticised.

In his essay, he tried to link classic concepts of electromagnetism (area covered in Physics) to the living cell and cell nucleus (covered in Biology). He suggested the presence of an "H field", present inside the cell's nucleus. According to Pinel, this "intranuclear field" is created by a "magneto-biology law of vital induction" which is present in every living thing. To him, "this law creates a field that, as a result of its actions, has a role of magnetic field; it is similar to Lenz law in induction Physics". He clarified that "the H field has, as a result of its actions, a role of magnetic field which can thus be associated to the magnetic field studied in Physics", "H is located in the cytoplasm in which the nucleus is, not as a transmitter field like H, but as a receiver field that executes the orders of the nucleus cell".

In this way, this field could give a line of explanations as for the fact that the cell can both produce and receive information, apparently electromagnetic according to Pinel.

Since 2009 and Montagnier's experiences, discussions on theoretical grounds keep increasing and always go in the same direction, such as Cifra and Prasad (in 2011 and 2014 respectively).

Discussion and conclusions

All of the experimental research works realised between 1923 and 2015 dealt with a new non chemical-physics intercellular communication that highlight time an intercellular communication based on a genetic electromagnetic information.

Every author mentioned in this paper, coming from different research teams and different countries, highlighted either a cancerous cellular culture, or a living tissue at different stages, for example that respectively caused cancer or acceleration in the development of the control groups, and this without any chemical-physics communication, but with an electromagnetic information.

It appears that after Luc Montagnier's experimental results in 2009, no actual link was made in the scientific literature between his data and an intercellular communication based on electromagnetic information. Indeed, his experimental results did not directly question this type of signals. Nevertheless, it seems that all the data were already present in the scientific literature.

In the end, we do not know whether Pinel proposed his theory after the first experiences were realised in Germany in 1923 by Gurwitsh and in 1970 by Popp. Nonetheless, at this time, these experiences could only suggest the reality of an electromagnetic waves transmitter field. Nowadays, the Nobel Prize Winner Luc Montagnier's experimental results in 2009 brought new data which prove the existence of such a communication field produced by DNA.

Finally, we can see in the light of these data a totally new phenomenon to the actual paradigm which appeared in 1923 up until now and was controversial,

illustrated by an accumulation of anomalies that affected the founding principles of the actual paradigm.

Besides, this analysis allowed us to highlight and list four precise indicators. In fact, it appears that: from the proliferation of rival variations of the actual paradigm, from the expressed dissatisfaction, from the numerous methodological approaches tested, and from the multiple discussions on the founding principles of the actual paradigm; all the following criteria are the features proving the existence of a scientific crisis.

But, as previously seen, the philosophers in science agree that the conception, according to which science is continuously developed thanks to successive discoveries that do not question its founding principles, is a heresy. It is obvious for them, as Bachelard illustrated with the "epistemological obstacle", that science is developed thanks to discontinuities: we call this a change of paradigm.

Even though Fuller (Fuller, 2006) underlined, that the general model of Kuhn's scientific revolutions was elaborated from several historical facts in Physical Science dating back to many centuries ago, and in a perspective that Pestre (Pestre, 2006) named the judged history. This form of history stipulates that today's scientific results allow to judge previous propositions and, as he said, "to distinguish, as the scientific before used to say, what falls under the order of the world's truth and what is the order of the prejudices and social" (p. 32) and this, even if you support the thesis on the incommensurability of the successive paradigms.

Incidentally, Kuhn determined that a paradigm crisis and the beginning of a scientific revolution result from an anomaly that occurred during an experience, which aim was to precise something else or a disagreement with the paradigm. According to the epistemological theories, the accumulation of anomalies led to a paradigm crisis. This crisis is set but cannot continue and that is why a new paradigm is created in order to explain the anomaly found in the previous paradigm. Thanks to its adoption by the scientific community, it reaches a new step of "normal sciences". Callon and Latour (Callon & Latour, 1991) noted that Kuhn's works allowed to make the social and intellectual explanations and the production of knowledge compatible. According to its authors, he succeeded thanks to his use of the paradigm's concept:

> The blurred magic of the word "paradigm" fits in this double meaning: it indicates a certain way to understand and perceive the world, arbitrary, coherent and irreducible to any other [...], but is also a social organisation with rules, solidarity, learning, a proper identity. Why were the social and cognitive separated for so long? The two of them are inseparable and the group would not be able to define themselves outside of these conceptions of the world that its members share and which structure the knowledge it produces; In return, without the mechanisms of social integration, learning, transmission of a cultural matrix, it would disappear and would not have any consistence. With this solution, everything is inextricably socio-cognitive: the arguments, the proofs, the research problems cannot be separated from the social game they are involved in. (p. 18).

However, this analysis led us to think about the distinction between a rival theory and a change of paradigm. Indeed, are all of the identified clues in this study really representative of a possible paradigmatic crisis in progress, or is it only the reflection of a rival theory emerging?

For Kuhn, it seems that every perception is linked to an intention. According to this author, every measure, every fact is bound to a paradigm, which explains why once a new paradigm is in competition with a previous one, the discussion is not only based on the disproof and facts, but also on the belief in a paradigm. Most of the former paradigm's disciples do not change their mind, no matter the experimental 'proofs' brought, because they are meant to be read only with the new paradigm; they are not understandable with the former paradigm.

That is actually what differentiates Popper and Kuhn. Popper thinks that the theories are no representations and that it is impossible for the scientific discoveries to come down to a psychologic disruption. So as to have a logical scientific discovery and a rational evolution of the scientific knowledge, science must not compete with mental constructions, representations determined by *causes*, but will with symbolic constructions, theories loose from a thinking subject, likely to logically select on *reasons*. However, he thinks that a scientific theory comes along with a certain representation of the world which can psychologically affect our subjective relation to reality. In this, he partially agrees with Kuhn who suggested that the passage from a theory to another comes under a sociological and psychological causal mechanism, and not from a critical exam. He thus defined a paradigm as the acceptation of a unifying theory among a sociological system of beliefs in the scientific community.

It finally appears that the awareness and the manifestations of the sociological and psychological dimensions of the scientific anomaly studied through different indicators allow us to question a paradigmatic change and not only on the confrontation of two rival theories. Indeed, the emergence of this anomaly led us to question once again the unifying theory of the actual paradigm.

Can we thus talk about a scientific crisis?

If such a paradigmatic crisis is in progress, it would allow us to suggest a new vision initiating a scientific revolution: a complementary intercellular communication, both chemical-physics and electromagnetic.

Yet, all of the biomedical researches are based on the lock and key conception and a chemical-physics communication. A new vision would revolutionise the biomedical research's approach.

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Paradigmatic crisis and biomedical research

Abstract

The actual paradigm and the chemical physics conception established do not refer to any intercellular communication of an electromagnetic nature. But the scientific literature from 1970 to 2016 mentions another form of intercellular communication based on ultra-weak electromagnetic signals. Several works have been led by different research teams from different countries, who put forward the same data.

Nonetheless, a paradigm was defined by Thomas Kuhn as the acceptance of a unifying theory within a sociological system of faith in the scientific community. Can we thus speak of a crisis of the actual paradigm?

We can see in the light of these data a totally new phenomenon to the actual paradigm which appeared in 1923 up until now and was controversial, illustrated by an accumulation of anomalies that affected the founding principles of the actual paradigm. This analysis allowed us to highlight and list four precise indicators. In fact, it appears that; from the proliferation of rival variations of the actual paradigm, from the expressed dissatisfaction, from the numerous methodological approaches tested and from the multiple discussions on the founding principles of the actual paradigm; all the following criteria are the features proving the existence of a scientific crisis.

The emergence of this anomaly led us to question once again the unifying theory of the actual paradigm. If such a paradigmatic crisis is in progress, it would allow us to suggest a new vision initiating a scientific revolution: a complementary intercellular communication, both chemical-physics and electromagnetic.

Key words: paradigmatic crisis, biomedical research, scientific revolution, scientific community

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