

The Essence of Communication, Charm and Mystery of Wave Motion

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ABSTRACT

Communication/interaction is a universal phenomenon that connects everything that is made up of material substance, including the space-time in which the substances are present. This phenomenon has reached the maximum effectiveness compatible with their biological nature in living things.

- It is a phenomenon that raises numerous questions:
- Why is communication based on the presence of material bodies in a specific context and it is expressed with a change in the properties of the space-time in which it manifests itself?
- What are the ways in which it is transmitted?
- What is the necessity and meaning of the interaction between material bodies?
- What are the mysterious interactions and paths that matter follows to form the countless objects present in nature, using a limited number of elementary substances?

Various answers have been provided to these questions over the centuries, but many aspects remain unclear. In this article I'm going to present a personal conception of the meaning of communication and its characteristics, relating it to the properties of material bodies that inevitably interact with each other.

Keywords: Interaction and Communication; Wave Motion; Formation of Molecules; Receptor Systems; Art Communication

The following Definitions and Comments are preparatory to the description of the topic of this article:

Definitions

- **Space Time:** They are two conventional non-measurable abstract quantities that indicate an indefinite place (SPACE) in which events occur that have an ordered and progressive succession (TIME) anterograde or retrograde, it also indicates times and places of past events that can be known if they left traces.
- **Matter:** Substance that has a shape (the space it occupies), a composition (the homogeneous or non-homogeneous particles that constitute it) and an energy (ability to modify the shape, composition and energy content of other matter). This implies that material bodies have the ability to interact with each other and that they can change with interaction.

- **Wave:** A quantity that has a trend that is repeated in time and in space passing through two fixed points.
- **Oscillation:** Alternative motion, with periodic trend, of a body, around a fixed equilibrium position.
- **Vibration:** Relatively small amplitude oscillation.

Comments

The concept of space-time, hypothesized by Einstein as an immanent universal physical quantity, raises some fundamental questions:

- Is space-time a sempiternal immanent property of the universe and is it prior to the presence of material bodies, or is it generated simultaneously with the presence of the bodies themselves?
- Is the force of gravity the result of the deformation induced by the presence of bodies in space-time, or is space-time generated by the presence of the masses themselves?

- Is space-time originated and shaped by the presence of matter, or is space-time collapsing and generating the matter that deforms it?
- If it can be deformed by the presence of large masses, such as celestial bodies, and give rise to the field and gravitational force, as hypothesized by Einstein, this implies that space-time is made up of consistent material substance, otherwise it could not deform;
- The deformation of space-time produced by an astral mass acts on all the other masses present in its sphere of influence and modifies their state of gravitational equilibrium;
- The gravitational interaction is reciprocal between all the masses present in the same space-time and must be modulated to reach an equilibrium condition of the system as a whole.

Introduction

I have dedicated some articles to the topic of communication, its expressions, its meaning, its *raison d'être* [1-4]. My interest in this specific topic derives from the fact that, according to the thesis presented in this article, communication is the very essence, the fundamental property of matter in all its manifestations. Wave motion is the most effective means that makes the interaction and communication of material bodies separated in space-time possible. And it is the effective means capable of modifying space-time and faithfully transmitting the qualities and energy of the material bodies that generated it, in harmony with the variation of their oscillatory properties. While, for example, uniform rectilinear motion can only modify one dimension of space-time and therefore has a reduced informational content. With wave motion, material bodies change the coordinates and characteristics of space-time point by point during its propagation. It is by virtue of the wave movement that we know the universe that surrounds us, because it transmits to us the properties of all the material bodies that generated it. Defined in this way we understand why oscillatory motion is the means universally adopted by cosmic evolution to transmit information. Having admitted this hypothesis, we ask ourselves why all the information that material bodies transmit and receive, sounds, lights, rays of various nature and energy, gravitational or magnetic attraction, and so on, adopt this means of communication? Whether the waves transport elementary material particles or not, they are still oscillations.

Even the phenomena produced by the mutual interactions of wave movements, interference, resonance, echo, etc. they are the effect of the wave properties of matter. The presence of a quantity of matter in space-time produces a change in its environment and generates mutual information of the changed pre-existing equilibrium conditions. By acting in this way, matter deforms the space-time it records, "feels" that the deformation has occurred, while the matter that deformed it is informed of the presence and properties of the space-time that

surrounds it. From which it follows that communication is a two-way process that brings together discrete quantities of matter which can thus probe mutual knowledge from their properties. But what is the advantage of communication, if it is an advantage? Whether an advantage is gained from it or not, communication is a direct consequence of the presence of matter, as we have said, which in addition to testifying to its presence transmits the unique characteristics that qualify it, such as shape, size and energy content. This is information that is not an end in itself, but is fundamental for material bodies to probe and recognize the presence of the external environment and search for entities that are compatible with their own characteristics and with which they can possibly build a relationship or experiment. a possible bond or mutual transformation. The immanent search for new communications and contact opportunities is fundamental for the evolution of matter and occurs continuously, spontaneously and randomly, without pursuing a teleologically determined plan.

How else could we explain the infinite magnitudes, forms and states of aggregation of matter, apparently devoid of meaning and reason for being, which fill the universe? And why have transformations continued to take place for billions of billions of years? Perhaps because an equilibrium in the system as a whole has not been achieved? Or more simply, why is there no pre-established goal to be achieved? Given the unavoidability of communicating material bodies by the fact that they occupy a defined space-time, what are the effective ways of communication and contact between them in the search for a balance, which if present individually, it would make no sense to reach. In fact, equilibrium is the dynamic result of the search for lower energy content of the entire set of bodies present in a specific space-time environment, while an isolated substance cannot be in equilibrium with itself, it can only move without a pre-established goal. The methods of contact depend on the intrinsic characteristics of the material substances, as we have identified them above, but in any case, it is essential that they adopt the same code or language, otherwise no interaction and communication is possible. A possible answer to the questions posed previously is offered to us by the theories that science has formulated on the structure of matter, in particular by the theories of quantum mechanics [5,6]. If we stick to these theories, we must admit that the structure of matter is formed by equal or different atomic particles that can contain electric charges in equilibrium, and are in constant motion in their environment.

We can then assume, as quantum mechanics itself informs us, that with their kinetic movement the charges they transport can generate a particular form of energy which has been defined as electromagnetic energy, and has electrical and magnetic properties. In essence we know that this energy is expressed and transmitted in wave form, which due to its intrinsic properties is capable of transferring a series of information with a single code. The particles with their wave motion modify space-time and are therefore able to transmit information and communicate. Thanks to the infinite values that wave motion can

assume, it can transmit an infinite range of information, for this reason all moving or apparently immobile bodies can generate and transmit various types of waves. The waves are distinguished, in a first approximation, into elastic or mechanical waves and electromagnetic waves. Both are characterized by shape and energy content that can take on an infinite number of values, and therefore can transmit an infinite amount of information, represented by the sound and electromagnetic spectrum, Figure 1. Otherwise, a body in uniform rectilinear motion can only transmit its position in space. All substances emit the

waves produced by the atoms that form them and which we observe when we study their properties through the characteristic emission spectra. And it is the system with which, for example, the atoms of the periodic system can be distinguished. In the construction of the complexity and magnitude of atoms, Aufbau principle described by quantum mechanics, it seems that a dimension and complexity has been reached beyond which the energy and structural content cannot be structurally stable and in equilibrium (unstable nuclei).

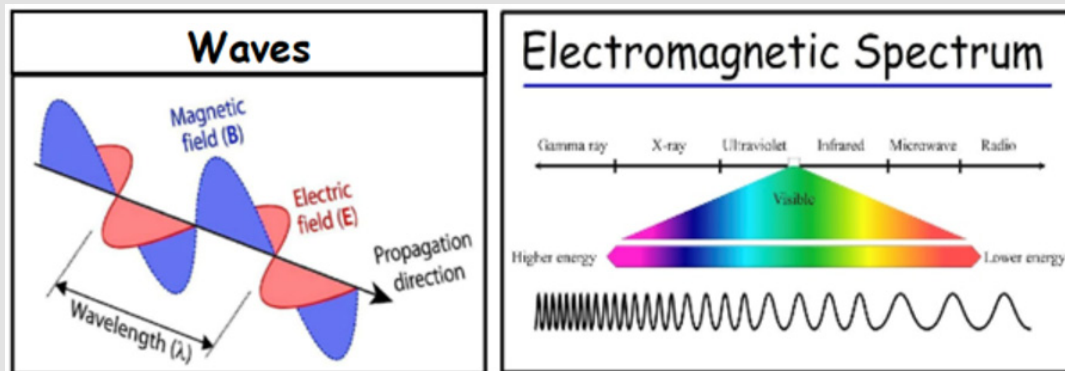


Figure 1: Waves and Electromagnetic Spectrum.

So, in order to form new and more complex structures, the only possible way was to assemble atoms of different types and quantities. The random assembly of atoms based on their size, energy content and morphogenetic affinity has produced the astonishing number of complex structures that exist in nature and in the universe. If we try to identify the driving forces and mechanisms used in the construction of molecular complexes, we fall into a state of frustrating awareness of the complexity of the research and the limitations inherent in our cognitive system, even though it is the most advanced among those present in nature. From this it follows that the only chance we have to investigate the universe, is to adopt a study method and a system of formulas and arbitrary codes shared and compatible with our cognitive and descriptive abilities with which to build a set of theories on the essence of the real world, and which allows us, at the same time, to communicate and be able to discuss the consistency of the results obtained. Which brings us back to the problem of communication from which we started, and increases the complexity in outlining its contours and the essence of its functioning. It is completely clear that the method and communication tools must be unique and shared by all the matter present in the universe and which interacts, including man, and must necessarily be dependent on the properties of matter as we have outlined it. Do electromagnetic waves have all the requirements to form the universal code of communication? Let's examine it in detail.

Evolution of Molecular Structures

Communication is a sensitive topic and is of fundamental importance in any type of spontaneous or intentionally produced natural activity. Nothing can happen in the real world if communication does not first occur in the matter present in it and before that a mutual interaction must take place. Any event that modifies the stationary state of the universe, or to use Einstein's words of space-time, is immediately signaled and perceived by space-time itself and secondarily by the other material bodies present in it. Every material substance leaves with its presence its own "molecular imprint" in the surrounding environment, which is the result of the space occupied by its steric conformation, and is typical and distinctive of the substance Figure 2. and each material substance receives and emits electromagnetic waves or particles charged with energy, to the others, allowing mutual interaction and recognition Figure 3 Even if we imagine the singularity at the origin of the universe, theorized by quantum physics, as long as it remained motionless it produced no variation and no new information to communicate, but when the transformation began to generate universal matter, by the Big Bang and nucleosynthesis was then perceived by the entire system as a new entity. We take this phenomenon as granted but if we consider the simplest of events, let's suppose two atoms immersed in the universal void, for the most insignificant infinitesimal change to be produced that has meaning for both, it is necessary that they can interact and communicate their state to eventually and casually being able to meet and perhaps merge into a new entity.

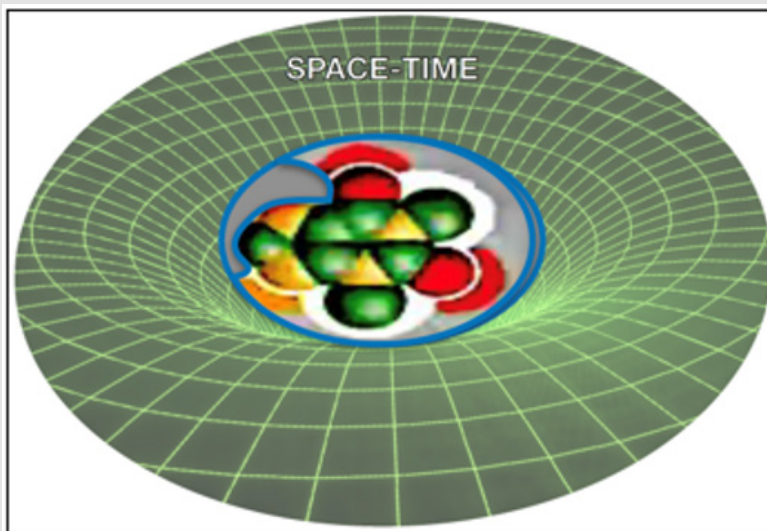


Figure 2: Molecular Imprinted.

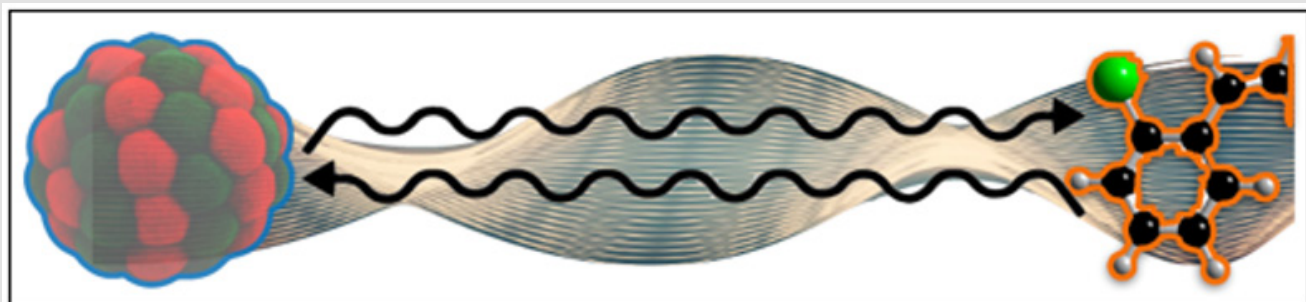


Figure 3: Selective Interaction.

The main way in which molecular transformations occur is explained through shock theory. The molecules of interacting substances can exchange atoms and give rise to new products only if they collide and come into contact with each other, and if the collision is effective, then a new molecule is formed Figure 4A. The formation of the new molecule passes through a state of activation Figure 4B. This description is an anthropomorphized method of considering events, as if elementary particles had consciousness and awareness of themselves and the surrounding space and the ability to recognize changes. But from the point of view of particles, they must have a perceptible and mutually recognizable size, shape and energy, otherwise

they could not interact, would not be observable, or simply would not exist. When I talk about communication and interaction, I mean precisely this, the possibility for every material entity to express its essence. This is not an intentional phenomenon but is linked to the very essence of matter which, in the moment in which it is present, cannot fail to communicate its presence, it is as if it were saying "here I am", and communicates it's being present through its properties intrinsic. planets, celestial bodies and galaxies in the universe were formed over billions of years. How does communication occur between material bodies as they increase in size and complexity?

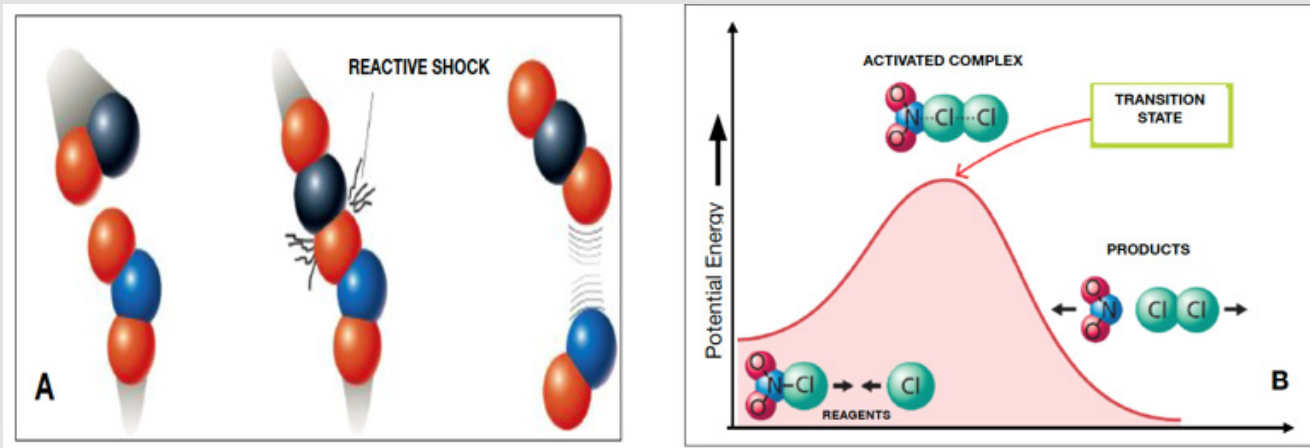


Figure 4: Interactions between molecules.

The Extraordinary Multiplicity of Forms Presents in Nature

Probably the most mysterious aspect is understanding how the countless forms that organic and inorganic matter took over billions of years originated. In nature there are a limited number of atomic particles, there are 118 in Mendeleev's periodic table of elements (1871), some of which have been produced artificially. Well, the entire universe was formed from these elements. If we restrict the examination to living beings only, we observe that there are only 15 elements that form the extraordinary quantity of living beings Table 1. The amount of random interactions that these elements had to experience to obtain the variety of forms present in the biosphere that populates the various terrestrial environments is unimaginable. Each interaction corresponds to a communication between similar or different elements which may or may not share part of their structures to give rise to new entities. This makes us understand that communication is the key event for the transformations that occur in nature. The progressive structural complexity of universal matter produced through evolution is the result of constant communication between the individual elementary substances that compose it. Communication was necessary to maintain the harmonious, synchronic and orderly balance between all the elementary components of matter during its evolution Figure 5, and between these and the surrounding space-time. In the absence of an integrated and synchronized mutual

interaction between all the elements that form a complex system, its functioning and maintenance of homeostatic balance would not be possible. We hypothesize that the interaction forces between material particles are generated by the deformation of space-time, similarly to what happens for the gravitational field and/or by the field that each particle generates based on its structure and its energy content.

Table 1: The main elements present in living states.

Simbolo	Elemento	Percentuale in peso
O	ossigeno	65,0
C	carbonio	18,5
H	idrogeno	9,5
N	azoto	3,3
Ca	calcio	1,5
P	fosforo	1,0
K	potassio	0,4
S	zolfo	0,25
Na	sodio	0,2
Cl	cloro	0,15
Mg	magnesio	0,05
Fe	ferro	0,006
F	fluoro	0,0037
Zn	Zinco	0,0032
Si	silicio	0,002

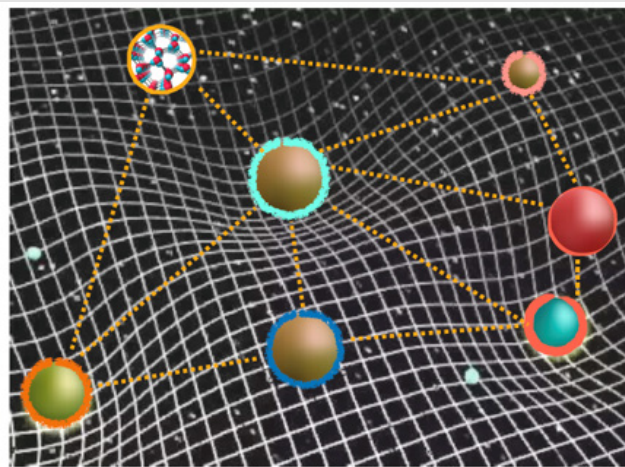


Figure 5: Harmonious and orderly balance of matter.

We do not know how the elements come into contact in the correct form and recognize each other by affinity to produce new entities. The mode of recognition cannot be left to chance because this would involve an infinite time before these interactions give rise to a useful compound [7,8]. What mysterious alchemies produce the combination of the same few elements to give rise to billions of plant and animal species? As far as we have know from quantum mechanics, communication between material bodies occurs with the emission of waves of different nature based on their characteristics and dimen-

sions. At a microscopic level, the prevalent interaction mode in material substances is based on the fundamental forces Figure 6, [9-11], which have an order of magnitude dependent on their mass and on the square of the distance between them, whatever the nature of the force, electric, magnetic, chemical, electromagnetic. The type of effect produced by these forces is generally a variation in the conformational or energetic state of the molecules involved and is more than sufficient in determining an effect that changes their nature and obtains an effective result with the birth of a new entity.

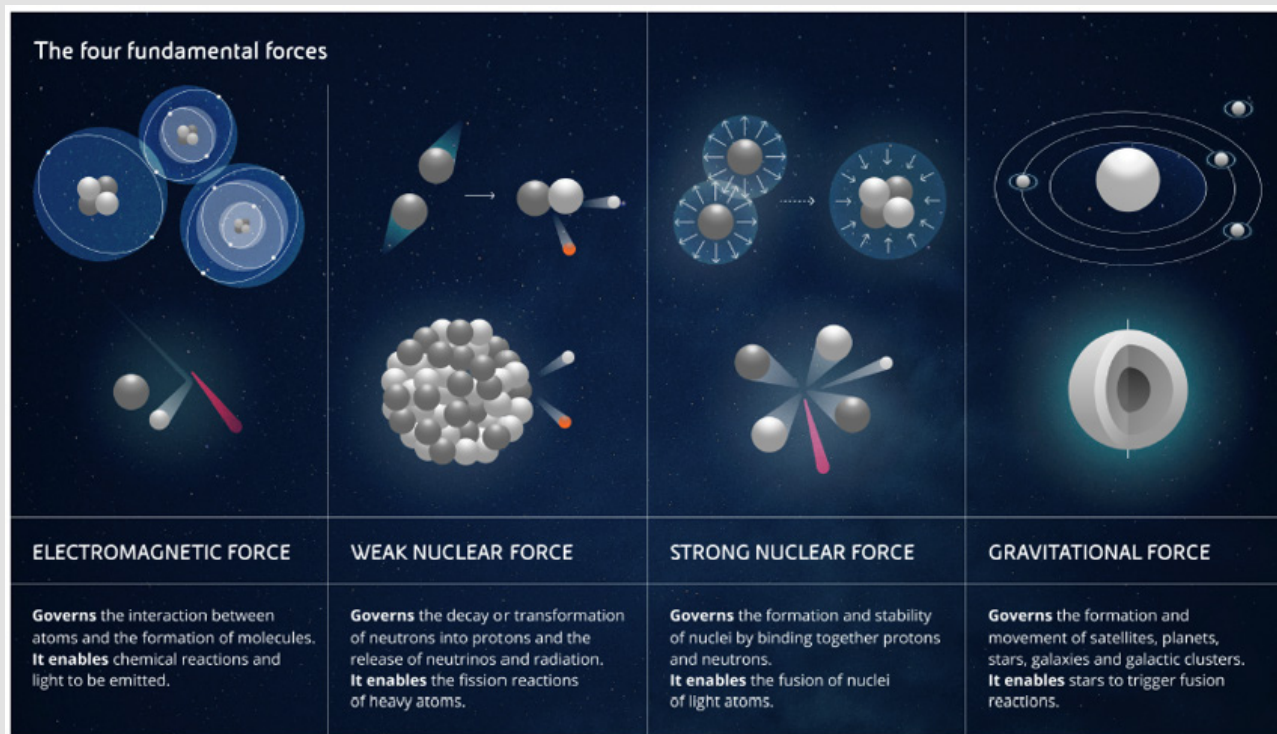


Figure 6: The four fundamental forces.

Communication in Living Things

Let us now use these considerations to examine what happens in the world of living things equipped with specialized systems for communicating. Typical examples are the responses of the receptors present in plant and animal organisms, which produce effects based on the stimulus they receive [12,13]. It is enough to observe the effects produced by different stimuli on animal and plant sense organs, and on photosynthetic structures. Assuming that the mode of transmission between material bodies is wave-like, the properties of these waves must be characterized. Once again, quantum mechanics comes to our aid by distinguishing between waves and mechanical oscillations: such as sound, sea waves, vibrating strings, etc., and electromagnetic waves and oscillations, such as light, radiation, then there are gravitational waves, which they are produced by the curvatures of spacetime caused by the presence of a body with a significant mass. Without using complicated formulas let's try to differentiate the various types of waves. Meanwhile we must make a first distinction, there are corpuscular waves that transport matter and energy, they are all electromagnetic waves, and there are mechanical waves that transport energy without transporting matter, such as sound, earthquakes, sea waves, gravitational waves, etc. Both can vary due to their physical characteristics (length, amplitude, frequency) and the presence or absence of the corpuscular component transported by them (electromagnetic). This distinction is fundamental to define the type of communication.

The communication that occurs mainly in a physical medium uses mechanical waves that modify the energy of the medium in which they are transmitted, while the waves that are transmitted in the vacuum, which is space-time without dimensions, use the waves produced by their moving corpuscular component. In electromagnetic waves the presence of the corpuscular component is necessary, otherwise they would be simple mechanical waves. Gravitational waves are precisely mechanical waves emitted by celestial bodies of considerable size and inert mass, while electromagnetic waves are emitted by celestial bodies endowed with great mass and great energy, so great that it partly escapes their gravitational force, generating particles charged with energy. Compared to living matter, the quality of the waves characterizes and defines the receptor systems capable of recognizing their properties and using them for communications [14-16]. It is interesting to observe how the receptor systems have specialized in responding to wave stimuli, differentiating themselves into mechanical-vibratory type receptors, these are the mechanoreceptors, (hearing, touch, balance), or receptors sensitive to wave-particle type stimuli (sight, smell, taste, photosynthesis), or receptors sensitive to chemical stimuli, chemoreceptors, receptors sensitive to heat, thermoreceptors and finally, receptors sensitive to electrical charges, electroreceptors, Figure 7. As regards the receptors of smell and taste, which are chemoreceptors, it must be considered that the transmission of the signal occurs by means of special molecules, odorous substances, transported by mechanical waves and substances with flavor transported by solutions present in the nutrients and in the gustatory apparatus [17].

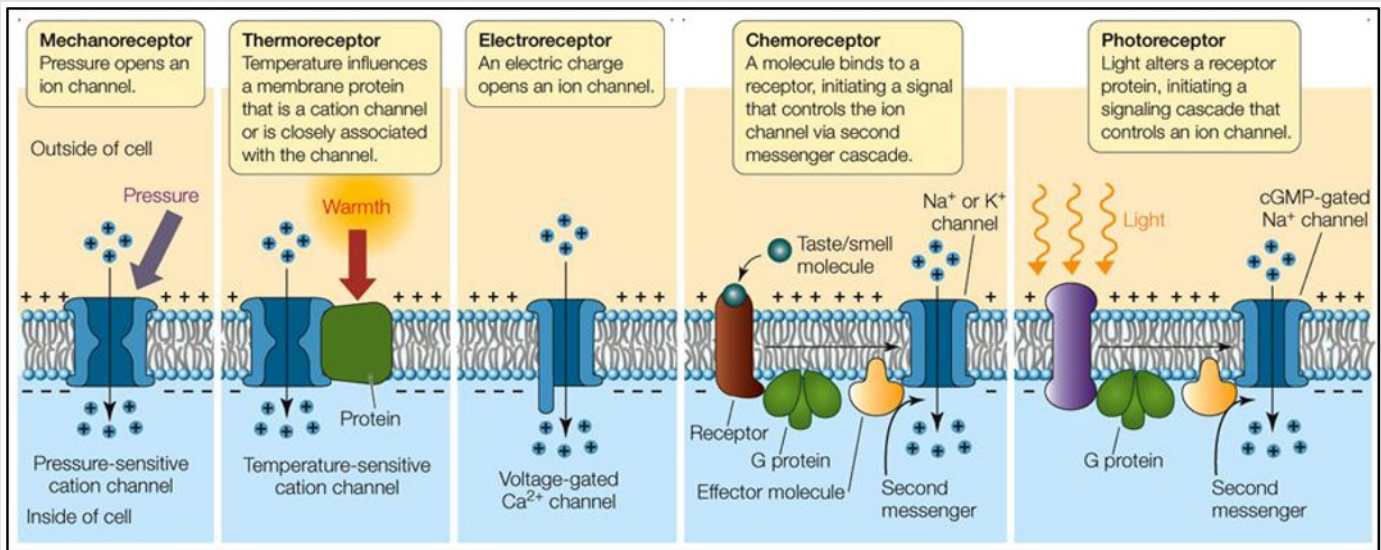


Figure 7: Schematic diagram of specialized receptor molecules to respond to various stimuli.

In any case, for every type of communication the presence of waves is essential, representing the means of transport of the molecular effectors, which produce the steric modifications recorded with the communication. The effective contact of communication occurs ultimately, either with a mechanical stress on the vibratory receptor organs, as in the Mechanoreceptors and Thermoreceptors, or with a modification of the conformation of the receptor protein structures, as in the Photoreceptors and Chemoreceptors Figure 7. And we understand why protein structures play the fundamental role of the sensory transmission system. As mentioned previously, these proteins have extraordinarily adapted to the stimuli they must receive, in electromagnetic or mechanical form, because they are able to modify their steric conformation, transmitting the information produced by the structural change to the parts of the cell or the nervous system which must process them [18]. Furthermore, they are under the strict control of the genome, and a point mutation in the genetic code on which their synthesis depends is sufficient to irremediably compromise their function. It is thanks to this possibility of modifying the structure of proteins and their ability to adapt to different stimuli that the evolution of receptor systems has been possible. Recent studies have confirmed the nature and fundamental importance of receptor proteins, an entire issue of the journal *Biochimica e Biophysica Acta* was dedicated to this topic [19]. In this regard, I report what was stated in an interview by Annika Barber, biologist at Rutgers University on the interactions between receptors and ligands: "First of all, something must enter precisely into a certain site of a protein, so the arrangement of the atoms of the protein is modified, which then does what it has to do."

This is a further confirmation of the corpuscular nature of the stimuli, which with their molecular imprint take on a fundamental importance equal to or greater than the frequency spectrum they emit. This explains why evolution has selected such specialized forms of receptor proteins and why they are perfectly complementary to the corpuscular stimulus that they must recognize, so that during their coupling they can adapt perfectly to the site in which the contact occurs. The mechanism is similar to that of the enzyme-substrate interaction, by which the substrate sterically adheres to the active site of the enzyme.

The Evolution of Communication

Previously we saw that interaction and communication are linked to the presence of matter itself, and we said that interaction is a one-to-one process that informs the interacting materials of the physical-chemical properties they possess. We also wrote that you cannot not communicate. But why does matter communicate? The answer cannot derive from our interpretation of the phenomenon, an interpretation that would introduce meanings linked to our knowledge and culture, and therefore of subjective value, but must be sought in an objective and detached way in the purely dynamic effect that the interaction produces, without seeking a final aim. Molecular interaction

is the way molecules interact with each other to form bonds, which can be weak or strong. These interactions can occur through different mechanisms, such as chemical bonds, noncovalent forces, and hydrophobic interactions. The interaction is followed by structural recognition which is the process through which molecules recognize each other based on their three-dimensional shape and structure. This can occur through the interaction of specific functional groups, binding sites, or molecular conformations that fit together in a complementary manner. Molecular interaction and structural recognition are fundamental in several biological processes, such as the regulation of enzymatic activity, the transmission of cellular signals, the formation of antigen-antibody binding, and so on. Recognition by means of molecular adhesion allows the distinction between different target molecules competing with each other through mechanisms that involve a conformational variation. As molecular complexity increased during evolution and ancestral living forms (prokaryotes) formed and differentiated into cellular structures, the task of communicating with each other and the environment became the responsibility of the receptors present on the surface of these cells. external [20-22].

Communication in Art

The effectiveness of communication that is transmitted to us through the waves reaches its maximum expression in the arts. In the figurative arts as in the musical arts, the oscillatory system is the vehicle that stimulates the emotions we feel when we observe a landscape or any pictorial or sculptural work or when we listen to a wonderful symphony. All visual and sound messages are an expression of the oscillatory modalities of the stimuli we receive. In the figurative arts our attention is captured by the chromatic variations and the relationship of the dimensions of the objects in contrast with the surrounding environment, while in sound messages we are struck by the tones and frequencies that we receive from musical instruments in their contrast with the noise or the background silence. The fascination and mystery of the sensations we receive has its foundation in the functioning of the different neurosensory systems which are structured to perceive the oscillations that are transmitted by the material bodies of the universe. It is a phantasmagoria of lights and sounds that transmit useful information about environmental conditions and their meaning for the survival of all living beings. The responses that the stimuli evoke depend on the evolutionary level reached by the neuronal networks that perceive them and on their state of environmental adaptation. At the lower levels of the evolutionary scale, plants and animals respond to stimuli automatically with simple adaptive feedback. At the highest levels of living beings, the adaptive response is expressed with complex behaviors that are inspired by a learning or recognition system and by comparison with previous events.

In humans, the system of neuronal networks has reached such a level of complexity that every single neuron is integrated and connected with all the others and with all the other parts of the body. In this way the information on internal and external environmental

conditions is complete to obtain the best possible adaptive response. Well, all the information is transmitted by the oscillatory system in the form of amplitude and frequency modulation carried by the waves generated with the action potentials of the neurons. If we reflect on the evocative value that oscillations produce in the sensory systems of various organisms, we are struck by the multiplicity of simple or complex responses obtained. Why does a particular landscape or artistic work produce different sensations and emotions of intense pleasure, annoyance or indifference? Why does certain music captivate us to the point of producing an intense sensorial enjoyment that we feel and manifests itself with the typical goosebumps? What properties do the oscillations that emotions give us share? Are they perhaps the oscillations that make the entire sensorineural system vibrate in unison, resonating in a single emotional symphony? But even more surprising is the choral sensation of emotions that the public feels when attending concerts or observing works of art in a museum or an enchanting landscape. A unique harmony of oscillations in resonance with each other makes the bodies and minds of men vibrate in unison when they come together to share their emotions and it seems that they form a single organism. It is the Charm and mystery of the wave movement that moves the entire universe.

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Author says he has not conflict of interest for this article.

References

- B Riccardi (2022) Phenomenology of perception, from stimuli to their interpretation, *World Journal of Advanced Research and Reviews* 16(02): 424-436.
- B Riccardi (2023) Specificity of cellular communication, from signal to functional response, *World Journal of Advanced Research and Reviews* 18(03): 549-560.
- B Riccardi (2023) In search of the universal code: The means of communication used by cosmic matter, *World Journal of Advanced Research and Reviews* 19(02): 519-526.
- B Riccardi (2023) Communication as an evolutionary factor of knowledge, from primordial organisms to complex collective systems, *World Journal of Advanced Research and Reviews* 20(01): 1210-1220.
- Brian Drummond (2019) Understanding quantum mechanics: a review and synthesis in precise language *Open Phys* 17: 390-437.
- Zeng Bing Chen (2022) The Information-Complete Quantum Theory, *Hindawi Quantum Engineering* 12 pages.
- Emile Zuckerkandl, L Pauling (1965) Linus Pauling; Molecules as documents of evolutionary history. *Journal of Theoretical Biology* 8(2): 357-366.
- B Riccardi (2023) Molecular Evolution: The Unsustainable Quantum Theory of the Origin of Matter and the Universe. *J Nucl Ene Sci Power Generat Technol* 12(3).
- Stergios Pellis (2022) Unification of the Fundamental Forces, *ResearchGate*, 27.
- Daniels, Adam, "Unification of Gravity and Quantum Theory" (2017). Faculty-Sponsored Student Research.
- Late Ulaanbaatar (2023) Supreme Theory of Everything: The Fundamental Forces in Quantum Hysteresis. *Journal of Applied Mathematics and Physics* 11(10): 3274-3285.
- Denes Turei, Alberto Valdeolivas, Lejla Gul, Nicolàs Palacio-Escat, Michal Klein, et al. (2021) Integrated intra- and intercellular signaling knowledge for multicellular omics analysis *Molecular Systems Biology* 17(3): e9923.
- Werner Jaross (2020) The Possible Role of Molecular Vibration in Intracellular Signaling. *J Cell Signal* 1(4): 180-186.
- Bastiaan C, Janneke Elzinga, Jan C M van Hest (2020) Intercellular communication between artificial cells by allosteric amplification of a molecular signal, *Nature Communications* 11: 1652.
- LLOYD M BEIDLER (1969) Chemical Excitation of Taste and Odor Receptors - Hornstein ; *Flavor Chemistry Advances in Chemistry*; American Chemical Society: Washington, DC.
- Rinu Chacko, Deepak Jain, Manasi Patwardhan, Abhishek Puri, Shirish Karande, et al. (2020) Data based predictive models for odor perception, *Scientific Reports* 10:17136 nature research.
- Iliia A Solov'yov, Po Yao Chang (2012) Klaus Schulten Vibrationally Assisted Electron Transfer Mechanism of Olfaction: Myth or Reality? - *Phys Chem Chem Phys* 14(40): 13861-13871.
- Cerruti L, Ghibaudi E (2018) Images, models, reality. The visualization of protein molecules, *New Secondary*, Cerruti L, Ghibaudi, E *New Secondary* 3: 31-35.
- (2014) *Biochimica et Biophysica Acta: Biomembranes - Volume 1838, Issue 1, Part A*.
- Mengqian Hao, Xiufen Zou, Suoqin Jin (2021) Identification of Intercellular Signaling Changes Across Conditions and Their Influence on Intracellular Signaling Response from Multiple Single-Cell Datasets, *Frontiers in Genetics* 12.
- Anna Bagorda, Carole A Parent (2008) Eukaryotic chemotaxis at a glance, *Journal of Cell Science* 121(16): 2621-2624.
- Kirsty Y Wan, Gáspár Jékely (2021) Origins of eukaryotic excitability, *European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program under grant agreement No 853560. Philos Trans R Soc Lond B Biol Sci* 376(1820).

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