American Journal of
Biomedical Science & Research

www.biomedgrid.com
ISSN: 2642-1747

Mini Review

The Importance of Electromagnetism for the Development of Life

Erich Ebner*

Hoher Weg 2,99425 Weimar, Germany

***Corresponding author:** Erich Ebner, Hoher Weg 2,99425 Weimar, Germany Hoher Weg 2,99425 Weimar, Germany.

To Cite This Article: *Erich Ebner*. The Importance of Electromagnetism for the Development of Life. Am J Biomed Sci & Res. 2025 26(1) AJBSR. MS.ID.003398,* **DOI:** 10.34297/AJBSR.2025.26.003398

Received: February 24, 2025; **Published:** March 03, 2025

Abstract

The study of life is becoming increasingly important. At present, the focus is primarily on the development of life from single-celled organisms. This is certainly important, because it is used to explain the diversity of the origins of life forms. But the singlecelled organisms from which we start are already complex systems that have all the characteristics of life, as we define life as such today [9]. The emergence of life, a process known as chemical evolution, began in the Hadean period around 4 billion years ago, the first part of the Precambrian period. In the second part of this period, it is believed that the evolution of life in the sense of biogenesis began. With these simple structural formations, the inorganic and organic structures separated. These structural developments are not accidental. The conditions that influenced the framework for the formation of organic compounds will be discussed below. In particular, the interactions of electromagnetic radiation and water with the first organic molecules with their entry into the early habitat of the earth will be examined.

Keywords: Electromagnetism, Control of simple organic molecules, Water structure

Introduction

The question arises as to how these highly complex systems arose from the simple organic compounds that have been found in space? The fact that matter developed from the energy of the early universe makes it seem logical that energy is the driving force of all developments and therefore also causes further changes. Energetically dynamic processes of atoms are therefore also responsible for the formation of organic compounds and their specialization.

However, this approach also includes the conclusion that life is not exclusively a phenomenon of planet Earth. The habitable conditions that developed with the formation of the Earth can exist in other places. However, the considerations on the origin of life will be limited to observations and research in the terrestrial space.

Discussion

Our planet is subject to the same basic physical conditions as cosmic space as a whole. The geophysical conditions that have developed during evolution have led to the emergence of peculiarities such as those of life forms. If one considers the dependence of life forms in the plant and animal realms, one can easily recognize the influence of magnetism and resonance energy as well as the electromagnetic radiation in the spectrum of light and its adjacent wave ranges. This fact of connection makes it easy to conclude that these physical phenomena were elementary in connection with the emergence of life forms and are indispensable in their continued existence. They are therefore fundamental and accompany the further development of biological life.

The decisive factors will be examined in more detail below. Organic compounds such as methane molecules, amino acid-like structures that have been found in space and in rock structures of extraterrestrial matter, are to be regarded as “rigid” forms in this

context and are not capable of development in this state. Only contact with water is the prerequisite for the formation of life forms. It is an indispensable factor in the development of the first organic molecules into self-replicating systems and thus into cells. It is the basis of development.

The structural properties of water play a key role. The water molecule structurally forms an angular structure (angle of 120 degrees). This leads to the creation of a dipole effect. The fact that there is a fundamental tendency in nature to form hexagonal structures is also found in water. The order of water is a main pillar in the structure of life, as Scent-Györgyi once put it.

Pollack points out that this hexagonal order is particularly found on surfaces [1,2,7,10]. McGeoch and coworkers [8] associate the hexagonality of the water structure with contact with proteins. The protein in question is a subunit of ATP synthase. This observation leads back to the idea of an evolving early organic matter which, triggered by amino acid-like and other simple organic compounds from space in contact with water, developed the beginnings of life forms in the terrestrial environment.

Back to the dipole characteristic. The arrangement of the atoms of the water molecule leads to a dipole effect. The dipole is a physical arrangement of two opposite charges, which appear as electrical charges or as magnetic dipoles. They are characterized by the distance and the amount of the opposing charges. The electrical dipole at the molecular level, as in the hydrogen molecule, is of particular importance in relation to the development of early life forms. The electromagnetic interaction is characterized by the range compared to third charge fields. It determines the structure of molecules. This seems to be the basis for chemical evolution, according to which spontaneous structure formation occurred far from thermodynamic equilibrium. The biological systems that are based on chemical evolution appear to correspond to largely non-linear dynamic systems. It is therefore conceivable that, regardless of the abiogenic formation of biomolecules or the further development of simple organic molecules, unexpected end states of organic, highly developed molecules arise after a correspondingly long period of time.

Water stores energy. It receives energy from the light that is incident on it [10]. A photon has no mass, but it has an energy of $E=h\nu$ and a momentum of $p=h/\lambda$ (λ -wavelength of the light). The mutual influence of photons and electrons is therefore of fundamental importance. The energy of the electrons is proportional to the frequency of the radiation. The energy is absorbed. The effect of light on water is not thermal. The derivable resonance energy has an effect on the molecules, leading to molecular vibrations with an increase in energy, because the incident electromagnetic radiation indicates an oscillating electric dipole moment in the system under consideration. Accordingly, reactions are often triggered by electromagnetic impulses. In the ground state of a molecule, the nuclei are in equilibrium. However, if an electronic transition takes place, the molecule can vibrate and this leads to a vibration structure. Processes that trigger photochemical reactions are particularly important here, as shown by the absorption of the sun's radiation energy during photosynthesis. But here photochemical and photophysical reactions interact with one another. In the excited state of a molecule, it must return to its ground state or be converted into a new product. From these conditions, triggered by electromagnetic radiation, the possibility of the formation of new organic compounds can be deduced, which in a long-term phase of development can explain the diversity of organic matter up to complex structures. An increasing number of elements of the early primordial substance took part in the important and probably complicated chemical reactions. However, electron transfer is always a fundamental physical element, as described by the Marcus theory.

The energy difference between the ground state and the electronically excited state causes an interaction between the molecules, an interaction that can be seen as a dipole-dipole interaction in the form of Van der Waals forces or hydrogen bonds. Van der Waals forces are relatively weak non-covalent interactions between atoms and molecules. They are weaker forces than covalent bonds. In contrast, hydrogen bonds are based on attractive interactions between covalently bound hydrogen atoms. Hydrogen bonds per se show different bond strengths. According to Jeffrey [5], they are weakest in proteins in a range of 10-100 kJ/mol, as is the case with the bonding of secondary structures. Hydrogen bonds are responsible for various properties of water. With a bond length of 0.18 nm and a bond angle of 180°, two bonding patterns occur: a linear bond and a nonlinear or tetrahedral bond, which, as described above, make up the structural and physical characteristics of water.

The sun's nuclear fusion processes release energy that is emitted into space as electromagnetic radiation. Due to scattering losses and selective absorption in the atmosphere, the energy flow of the radiation from the solar constants is reduced from 1.4 $kW\times m^{-2}$ to ≤ 0.9 $kW\times m^{-2}$. About half of the energy is in the spectral range of 300-800 nm, which is the optical window of the earth's atmosphere. This area is therefore in the area of photochemically effective radiation or, in other words, forms the electrochemical potential [12]. Due to the special physical properties of the surface of the water, only the higher frequency components of the color spectrum are allowed through with their energy [1]. All other frequencies of light are filtered out. The incoming energy causes molecules to break up. In this sense, water molecules also break up so that they can come into contact with other substances. The energy determined by wavelengths is in resonance with the water molecules [3]. However, this does not only apply to "exposed" systems. Research has found biological life forms to the same extent, i.e. cells in deep rock, so that one must assume that thermal movements of atoms in a space of the black radiator stimulate the oscillators of the electromagnetic field and energy-generating radiation occurs. Infrared radiation is always present, even in the apparent dark area. The energy is quantized according to Planck's distribution.

The impotance of electromagnetic radiation, tracing back from the findings of photosynthesis in today's plants to the earliest forms of living matter such as bluegreen algae, shows the fundamental importance it has in evolutionary development. It is part of all en-

ergetic processes. However, living systems are actively involved in the thermodynamic devaluation of energy that is constantly taking place on Earth, as described by Schober and Brennicke [12]. The irreversible conversion of free enthalpy into positive entropy in the sense of the second law of thermodynamics is the engine of life.

The complexity of life processes cannot yet be fully explained by the research areas of cell biology, molecular biology and other specialist disciplines. However, there is no doubt about the theory of evolution. The emergence of mutually influencing functions and information is the basis, so that great expectations are placed on studies of the major building blocks of RNA and DNA. The concentration on the electromagnetic range of UV light also appears interesting [6,11]. But these considerations are aimed at younger phases of chemical evolution, which leads to specialization. It is clear, however, that the physical regulations and influences have been preserved from the beginning of development up to today's highly developed and differentiated forms of life and are able to control them [4]. A mental leap from the origin to today's knowledge underlines this. The ostensibly acting UV radiation as part of electromagnetism on early simple organic compounds of the primordial sea is reflected in today's metabolic processes, so that reaction pathways obviously exist, the clarification of whose continuity can provide significant insight into developmental processes of evolution.

Conclusion

The variety of interpretations of the development of life in research cannot be fundamentally contradicted. However, it seems necessary to place greater emphasis on the energetic and thus physical conditions that led to the emergence of life forms and still play a decisive role in relation to all life today. Electromagnetic radiation is particularly fundamental here, as it triggers fundamental reactions in its mutual influence with water. It seems obvious that this is the only way in which the existence of organic molecules in space developed into life forms on earth.

References

1. Chai B, H Yoo, G H Pollack (2009) Effect of radiant energy on near-surface water. J Phys Chem B 113(42): 13953-13958.
2. Chatzidimitriou Dreismann C A, T Abdul Redah, R M F Streffer, J Mayers (1997) Anopmalous deep inelestic neutron scattering from liquid H2O-D2O: Evidence of nuclear quantum entanglement. Phys Rev Lett 79: 2839-2842.
3. Del Giudice E, V Voeikov, A Tedeschi, G Vitiello (2012) Coherence in aqueous systems: Origin, Properties and consequences for the living state In: Fields of the cell. Ed.:D Fels and M Cifra Cap 4.
4. Ebner E (2021) Ultra-week cell radiation as an impulseto activate biological signals Adv Bioeng Biomed Sci Res 4(3): 75-76.
5. Jeffrey G A (1997) An introduction to hydrogen boding Oxford University Press. ISBN 0-19-509549-9.
6. Kufner C L, W Zinth, D B Bucher (2020) UV-indudess charge-transfer states in shut Guanosin-containing DNA oligonucleo tides. ChemBiolChem 21(16): 2306-2310.
7. Ling G N (1992) A revolution in the physiology of the living cell. Krieger Publ Co.
8. McGeoch J E M, MV McGeoch (2008) Entrapement of water by subunit c of ATP synthase J.Roy. Soc. Interface 5(20): 311-340.
9. Nurse P (2020) What is life? David Fickling Books, Oxford.
10. Pollack GH (2013) The Fourth Phase of Water Ebner & Sons Publishers, Seattle/WA (USA).
11. Ranjan S, C L Kufner, G G Luzano, Z R Todd, A Haseki, DD Sasselov (2021) UV transmission in natural water on prebiotic earth. Astrobiology Oct. arXiv:2110.00432v1.
12. Schopfer P, A Brennicke (2016) Pflanzenphysiologie. 7. Auflage. Springer Spektrum, Cap 8.