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Five Arguments toward Understanding Life in Light of a Physics of the Immaterial †

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Abstract: This paper argues that life is best understood in light of a physics of the immaterial. Life is not properly seen or touched, for instance, but conceived, imagined, intuited. In order to rightly grasp life in general, we need not reduce it in any sense, hence its counterintuitive character. The claim is based on five arguments: life is much more a process than a series of components; the first law of thermodynamics is important in thinking about processes; life entails a twofold perspective that opens up the window, so to speak, to the possible rather than only the actual; living beings are not machines in any sense of the word (biological hypercomputation); and life is an autopoietic or self-organized phenomenon. Some conclusions are drawn at the end.

Keywords: quantum mechanics; information theory; origin of life; logics of life; complexity science

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1. Introduction

Firstly, information theory and then quantum biology revolutionized the understanding of reality, the universe, the world, and life [1]. A radical shift was produced from a material understanding of the world to the importance of immaterial processes, structures, and dynamics. The former was a take on reality based in general on the importance of the natural senses and empirical perception; the latter in contrast is highly counterintuitive. A twofold movement took place simultaneously: physicists and chemists dematerialized matter [2] and biologists devitalized biology [3]. The interplay and hybridization between information theory and quantum mechanics has opened up a fantastic view of life that allows for radically distancing it from traditional physical–chemical approaches [4]. In 2007, the first observations of quantum effects in living beings began to be registered [5,6]. Since then, a brand new perspective has emerged. This short paper brings out five arguments that support one single claim, namely that life is to be best understood in light of a physics of the immaterial.

2. Five Arguments about Life as a Nonmaterial Stance Rooted in Physics

It has been clearly and sufficiently established that life is founded on information processes [7–10]; systems biology, for example, is all about processes of information such as omics. This does not avoid but includes the classical recognition that life cannot be reduced just to physical, chemical, and energetic stances in the classical sense of the word. This paper claims that the understanding of life opens up the door to a physics of the immaterial very much according to information theory. Ultimately the field that arises on the horizon is biosemiotics, namely the study of how life, i.e., living beings, create, read, process, and interpret signs and signals, and not just symbols, a phenomenon that goes far beyond human history and far beyond biology in the traditional sense of the word, but includes the whole universe. Several consequences are henceforth highlighted.

Five arguments are provided to support the fact that even though life is physical, it cannot be reduced to physics [11].

2.1. Processes Rather than Components

The first argument assesses that even though life is indeed a physical phenomenon, we do not as of yet entirely know what matter is. On the one hand, there are the arguments arising from cosmology and quantum physics about dark energy and dark matter; on the other side, at the same time, the standard model in physics appears to be insufficient to understand and explain matter and energy [12,13]. Furthermore, information theory in general significantly contributes to the understanding of life in terms of processes rather than components [14]. We can and must turn our view from states to processes, thus shedding important light on to the interplay between physics and biology. Radically, quantum biologists know about a most crucial phenomenon in the universe that quantum physicists ignore, namely life, i.e., living beings, and their processes [15].

2.2. First Law of Thermodynamics

The second argument discusses how and why the first law of thermodynamics can rightly be understood in the framework of information. Accordingly, information is neither created nor destroyed but is incessantly changing. Understanding such a principle brings us in front of the gates of information thermodynamics [16]. The authors of this paper are aware that quantum thermodynamics, stochastic thermodynamics, and thermodynamics of small systems are only now being developed [17]. It is necessary to generalize stochastic thermodynamics with quantum field theory [18]. Being as it may, information dynamics can be viewed as a sort of leading thread among these fields, processes, and stances. The second argument just touches on the problem without entering into it, due to the limits of space.

If true, the second argument entails that truly nothing is ever created and that it does not need necessarily to disappear. At the limit, nothing ever arises, and never vanishes, for everything is continuously changing. The first and the second arguments are connected.

2.3. Life as We Know It and Life as It Could Be

The third argument is taken up from Ch. Langton about the importance of studying both life as we know it and life as it could be. Such a distinction is merely epistemic and sets out the ground for artificial life, which is a philosophical endeavor to understanding life by means of modeling and simulation. It seems that this philosophical stance has been undervalued due to the efforts of engineering to create artificial systems [19]. Important as these efforts are, the engineering enterprise is just a derivation of the task of understanding life in general—a philosophical endeavor, as it appears. In any case, both considerations—life as we know it, and life as it could be—are to be taken simultaneously and in parallel, not as complementary. This paper claims that an approach is need that is much more than methodological, but also both heuristic and logical. In other words, understanding life entails explaining both why and how it is real in its variety and diversification as well as how it could be possible. This, it must be argued, is the distinctive trait of a complex approach to understanding living beings. Thinking about life from both perspectives is the same as thinking about the possible and the impossible, not just about the real. Life evolves throughout adjacent possibilities and creates possibilities rather than actualities, because doing so is physically, biologically, mathematically, and biologically cheaper [20].

2.4. Hypercomputation

Subsequently, a fourth argument is set forth, namely that understanding the logics of life allows the problem of the origins of life to be solved. To be sure, a logic of life has been provided, which can be called biological hypercomputation [21]. Living beings are not a machine in any sense of the word (not even a quantum machine or a quantum information processor) and cannot be explained in terms of the Church–Turing thesis. In other words, we are to understand life not by what it is but by what living beings do. Living beings metabolize, process information, and are capable of homeostasis [22]. Computationally speaking, such features can be grasped as follows: living beings process information nonalgorithmically. These three processes provide three different ways to conclude that that life and information are closely intertwined, if not one and the same thing.

It goes without saying that living beings do process matter and energy; yet, information appears as the rationale for understanding both energy and matter. There are not three things—matter, energy, and information—but only one [23]. However, information expresses the best reality, the world, and the universe. It includes everything from bit to qubit, as Wheeler pointed out.

2.5. Self-Organization and Autopoiesis

A sound argument, then, is that life emerges as complex and creates the conditions for its own emergence and sustainability. The argument according to which some conditions are first to be created prior to the appearance of life is judged as flawed and ad hoc in the framework of complexity science and spearhead science. Thus, self-organization, autopoiesis, and an organismic grasp of life can be taken as equivalent. This argument is tied to the idea that information is not created nor destroyed but is unceasingly changing. In other words, there is never a beginning or an end but a continuous process of metamorphosis. The classical ideas about "beginning" and "end" are sheer simplifications adopted for the sake of claims such as "for all practical purposes" (FAPP), i.e., in a pragmatic albeit methodological and naïve take on things.

These five arguments are closely intertwined and, the reasons for their interconnectedness can, I believe, be easily explained and justified. The picture that emerges is one that allows us to claim that life sets up a mindset about a physics of the immaterial. A first-hand approach for such a physics can be viewed as biosemiotics. The reasoning goes along the classical argument from bit to qubit, but it also introduces a radical shift in that acausal explanations [24,25] are not different from autopoietic or self-organized processes and stances. The idea of a physics of the immaterial is explained and justified based on the arguments provided. Information theory radically modifies the ontology of the world and the universe, so to speak, and it deepens and enlarges the classical view about both the real and the possible.

3. Conclusions

There is no need to explain life in physical–chemical terms; doing so is a reductionist approach that has led to a dead end [26,27]. The interplay between the theory of information and quantum biology allows such a reductionism to be superseded [28]. Living beings have their roots in quantum mechanics even though they are normally seen as classical systems.

Reality is not what it seems, apparently [29]. This means that natural perceptions and the senses do not provide a sufficient account about the world or the universe. Physics is not just about material entities and phenomena, as the story from Aristotle, Aristarchus of Samos, Galileo, and Newton, among many others, wanted it to be. Moreover, and more exactly, physics is about counterintuitive processes, phenomena, and dynamics. Life as we know it and life as it could be emerge as the crux for a nonmaterial science. Quantum mechanics, information theory, and quantum biology open up the door wide open for a physics of the immaterial. Life is the thread that guides good spearhead research, very much like the case of Theseus against the Minotaur.

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