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Review Article

Living Organisms as Chemical Systems: What is the Difference Between Sleep and Syncope?

Zanou Ayao Edoh

Independent Researcher, United States of America.
ORCID iD: https://orcid.org/0000-0001-7113-5410
Email: ayaozanou@yahoo.com

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Abstract: This review article deals with quantum biology, the novel scientific tool that helps traditional biology unravel some of the mysteries surrounding living organisms. We continue with the contributions of Schrodinger and Prigogine to the field of biology; we explain why living beings produce entropy and describe the domain and range in which the entropy function is defined in the body. We posit a new classification of syncope and explicate why living organisms faint. We differentiate syncope from sleep and invite experimental scientists to find the limits of the entropy function at which the mind sends the body into syncope.
Keywords: Hypoxia, Ischemia, Orthostatic Hypotension, Reflex Syncope, Cardiac Syncope, Vasovagal Syncope, Postprandial Hypotension, Loss of Consciousness.

1. Introduction

Any researcher involved in sleep studies who discourses about slumber can also talk about syncope because both are kin. Sleep, syncope, coma, and death are all phenomena of the same family: they are all losses of consciousness in the physical body, as consciousness can be defined simply as a state of awareness of self and one's surroundings. While sleep and syncope are transient losses of consciousness, death is permanent and irreversible.

Many people believe science can never know what lies beyond death; they think whatever happens during syncope or sleep is also beyond the grasp of science, forgetting that science is simply a tool to investigate natural phenomena. Nothing is too big for science, and nothing is beyond the scope of science because science investigates. Science is similar to an intelligent creature with two hands; one hand digs the ground, seeking something; it is research; the other hand collects whatever is found: it is called the database. When the digger finds something, it shows it to the scientific community, who collectively agree; they put this finding in the database. When the digger discovers a new thing that contradicts the former conclusion, they reject the old one and admit the new result [1]. Thus, we cannot say something is beyond the grasp of science; we may not have the adequate tool to investigate a phenomenon at the moment; it does not mean that reality is beyond scientific comprehension; we are not ready yet. Notice that germs were beyond the grasp of science in the time of Ignaz Semmelweis. Science works progressively by putting pieces together to reach the whole picture. Consequently, from that perspective, we will delve into the unusual topics of sleep and syncope again to introduce new concepts to the public and the scientific community.

There are several pieces of literature about sleep and syncope; however, our investigations open a new avenue when we gather the work of the Nobel laureates Erwin Schrodinger, Ilya Prigogine, and Yoshinori Ohsumi. Except for Professor Ohsumi, who is a biologist by training, Schrodinger and Prigogine were not but made a smashing entrance into that field and opened our understanding of living organisms. With their works, we can formulate a robust theory of why living organisms sleep, faint, and die [2]. Since science provides rational explanations for circumfluent phenomena, this paper will attempt to develop a good explication of why people faint. Currently, science does not know why humans faint; however, scientists do understand how we pass out, and the most common syncope is the one that is neurally mediated and often called the vasovagal syncope [3-5]. Scientists classified the phenomenon into three categories: reflex syncope, cardiac syncope, and orthostatic syncope. This paper will devise and propose a novel classification

of syncope as we apprehend the phenomenon using quantum tools [6, 7]. We will explain how living organisms, as chemical systems, produce entropy. We will introduce the entropy function formulated over a century ago and describe its domain of definition.

2. Living Organisms as Chemical Systems

According to Professor Prigogine, the new science of stochastic and irreversible processes has supplanted the ancient science of deterministic and reversible processes. It is from that perspective he defines living organisms as dissipative structures. In addition to being open and complex systems, living organisms are chemical systems with remarkable coherence in such a way that many scholars operating with critical thinking marvel and suspect the presence of a special biological force (entelechy) or a designer. As Professor Prigogine himself noticed it at the end of chapter V of his book "Order Out of Chaos," I quote:

"It is true that when we come to a biological system such as the bacterial chemotaxis, it is hard not to speak of a molecular machine consisting of receptors, sensory and regulatory processing systems, and motor response." [8]

Before Prigogine, Erwin Schrodinger also pondered over the same problem in chapter VI of his book "What is Life?" and made similar remarks:

"It is by avoiding the rapid decay into the inert state of 'equilibrium' that an organism appears so enigmatic; so much so, that from the earliest times of human thought some special non-physical or supernatural force (vis viva, entelechy) was claimed to be operative in the organism, and in some quarters is still claimed." [9] If humans were solely flesh, as some materialistic scientists believe and teach, why do we sleep and faint? Why do living organisms die [10]? Progressive telomere shortening leading to senescence does not explain why people die from traumatic injuries [11]. Why do some newborns die as they fail to pick up their first breath? A dead man's heart is still usable in another individual's body; why? If nothing left the body, why did the first guy die? Is there any rational explanation for why living organisms sleep, faint, and die?

Our previous works show that living organisms sleep, faint, and die because of entropy fluctuation. Humans are dissipative structures, which means we are open systems that firmly depend on our environment; we exchange energy and matter with our surroundings. We are also chemical systems that produce entropy which unfortunately does not remain minimal and constant. Entropy continually fluctuates in the living organism, and because of that fluctuation, we experience spontaneous symmetry breaking that causes the entangled system degradation/synthesis to collapse, leading to death.

As Professor Prigogine and his colleagues showed in their investigations, chemical reactions lead to entropy production [12-16]. No living organism would die if the entropy produced could remain minimal and constant in the body. To mathematically apprehend this entropy fluctuation, we create a domain within which the entropy function must be defined and label it]Min(S), Max(S)[. Notice that entropy is a function, as Ludwig Boltzmann defined it, which Schrodinger reported in his book "What is Life?"

3. The Entropy Function and Its Domain of Definition in Living Organisms

In mathematics, a function is an expression or a law that defines the relationship between a set of inputs and outputs. That said, Boltzmann and Planck, who worked on entropy, described it as a logarithm function, mapping a set of disorders to entropy. Later in the middle of the last century, physicist Erwin Schrodinger imported this function into biology; chaos out of chemical reactions in the cell is mapped into entropy. The mathematical expression, as demonstrated by the work of Boltzmann, rearranged by Planck in part three of his book "The Theory of Heat Radiation," is $S= K\log(D)$, where S is the entropy function, D is disorder, and K is known as Boltzmann's constant [17].

All living organisms sustain chemical reactions in their cells. Prigogine marveled as he saw coherence as the most interesting aspect of all dissipative structures; order (synthesis) and chaos (degradation) go hand in hand. In chapter six of his book, Schrodinger broods over the mystery of life:

"What is the characteristic feature of life? When is a piece of matter said to be alive? When it goes on 'doing something,' moving, exchanging material with its environment, and so forth, and that for a much longer period than we would expect of an inanimate piece of matter to 'keep going' under similar circumstances."

In the next paragraph, he asked, "How does the living organism avoid decay?"

And he replied:

"The obvious answer is: By eating, drinking, breathing…The technical term is metabolism."

Thus, according to the Austrian scholar, the organism maintains life in the body by feeding on negative entropy. Through chemical processes, the individual feeds in 1/D, which is order. Therefore, we rewrite the equation based on his work in chapter six as follows:

KLog(1/D) = -KLog(D)= Negative Entropy or Negentropy.

As we know, every function is defined within a domain and has a range. Thus, we have associated (Min, Max) to the function S as all possible input values except the extremities. Chaos in the body cannot take these two values of Min and Max; all values between are acceptable. S is undefined at Min and Max; it only tends toward these values and could never touch them. Anytime the function approaches these values, the mind shuts down the body for correction and realignment.

Consequently, the limit of S, as chaos in the body approaches Max, is where we fall into syncope. In contrast, the limit at Min is the value of entropy where the natural sleep onset occurs (here, we tend to refer to the value of the entropy-hormone instead of chaos itself, realizing that cortisol must be cut off to induce sleep). Dissolution and death settle in the body when chaos reaches the values of Min or Max. Notice that sleep, syncope, and death are kin; they are losses of consciousness. While sleep and syncope are reversible and ephemeral losses of consciousness, death, on the contrary, is a permanent loss. Mainly, syncope and death occur at a higher entropy, meaning the maximal value is reached, especially in the case of death. The values of Min and Max can never be reached because the function is not defined at these two extremities; when the graph touches these values, it will trigger a spontaneous symmetry breaking leading to the collapse of the entangled system degradation/synthesis. Once the system disentangles, dissolution and death will settle in the body.

No living organism will die as long as chaos in the body is contained within the limits of Min and Max; that's where degradation/synthesis is balanced, the body systems are in relative equilibrium, and homeostasis is reached. The proper term used by Prigogine to describe such chemical compensation is "far from equilibrium."

Notice that Boltzmann and Planck worked on physical systems while human beings are living systems; thus, the logarithm function cannot fully explain the evolution of entropy inside a living organism [18, 19]. We believe Schrodinger was aware of it; being a physicist who introduced entropy into biology, he knew inanimate objects are different from living organisms. His discussion in chapter Seven showed he fully understood the reality of living organisms as he suggested a non-physical or super-physical law is yet to be discovered [12, 15]. Until further studies are done, we admit the logarithm as the best function describing the evolution of entropy in the body, although we know the description is partial because of sleep and syncope.

Like all logarithms, the function is undefined at 0, meaning the value of D could never be zero; hence Min cannot also be zero. All logarithms are naturally continuous and increasing, except that in the human body, this last one decreases as we drop off or faint, a phenomenon that is a singularity. We die at Min and Max and beyond because the function is undefined over there. So, the domain of the definition of the entropy function in the body is all sets of chaos or disorder over which entropy is still manageable to sustain life in the living organism.

4. Systemic Syncope and Punctual Syncope

In our investigations, as we apprehend the phenomenon of fainting through the lens of quantum biology, we distinguish only two types of syncope: systemic and punctual. Systemic syncope comprises all forms of fainting defined by medical schools; the root cause is within the body's organs and tissues. Any syncope related to system failure inside the organism is labeled systemic syncope. On the other hand, punctual syncope has an external cause and comprises violent impact such as an uppercut punch, gunshot, car accident, or a blow to the liver. The cause of punctual syncope must emanate outside the body and is often violent in nature, provoking a surge in entropy. Almost all syncopes are caused by a surge in entropy or a threat of potential degradation. When chaos in the body sends various organs down the road of spontaneous symmetry breaking, the mind triggers fainting to mitigate the damage. Past syncope, coma is the next step on

the degradation path before death [20]. However, the apparent causes that physicians often detect in syncopal episodes are low blood pressure, low blood volume or vasodilation, and a heart-related issue. Aren't these causes superficial?

5. Evaluation

When it comes to syncope, medical schools barely mention the physical trauma-related origin of the phenomenon; they focus only on the non-traumatic cause, which we mostly label today as systemic syncope. Physical trauma-related fainting is rare and often occurs during a brawl, an accident, or a fall; physicians call it concussion or traumatic unconsciousness [21]. The Medical staff doesn't classify such aspects of fainting among syncope families because consciousness is still a topic that eludes the scientific community. However, all fainting and syncopes seem to have the exact mechanism of action. Like sleep, fainting also is a mechanism of protection. We emit the hypothesis that syncope occurs at a high entropy value (massive degradation); when chaos increases to reach a maximal value, the mind shuts the body down by initiating fainting [22]. Our hypothesis is obvious for traumatic insults when a heavy blow knocks out the individual; however, non-traumatic or non-physical causes do not seem evident, and we will elucidate this aspect in this section to show why we propose a new classification. Since nobody in the medical field knows why we faint, our steps are justified to defenestrate the old classification and posit a new one that best fits reality.

Systemic syncope comprises reflex syncope, cardiac syncope, and orthostatic syncope. The most common reflex syncope discussed in the medical literature is vasovagal syncope [23, 24]. Physicians describe reflex syncope as fainting caused by a failure in blood pressure autoregulation. Cardiac syncope is caused by a heart defect leading to a low cardiac output that fails to perfuse the brain adequately. Orthostatic syncope is linked to a sudden drop in blood flow to the brain.

All these three syncopal episodes have to do with blood volume or blood pressure that fails to perfuse the brain adequately; the change in blood pressure directly impacts cerebral perfusion pressure resulting in poor brain perfusion. These three classes of syncopes generate an ischemic condition that will lead to hypoxia. As we know, the human brain is critically dependent on a continual supply of glucose and oxygen; brain cells start dying within five minutes of cerebral hypoxia; it is notoriously known in the medical field what damage ischemia can cause to living tissues and cells [25-27]. We can deduce that syncope is a mechanism to stop the potential damage from reaching the irreversible stage.

Notice that the entropy function is a logarithm that takes every set of chaos and slowly increases it to build up entropy that continually accumulates over time. I am an emergency medical technician by training; with all the financial struggle, lack of funding, and life's vicissitudes, I can say that I carry on my scientific investigations as an autodidact. My critical thinking ability, coupled with various revelations I received on human life several years ago as an amateur researcher in science and philosophy, make me stand in physiology and medicine. The scanty information available in these fields about living organisms and their existence urges me to take action; however, as a theoretical scientist, I do not know how the phenomenon accurately manifests at cellular and molecular levels to create fainting, but one thing is evident; hypoxia and ischemia are two dangerous conditions that lead to severe brain damage. And syncope appears to be a protective mechanism to help the body manage and control the upcoming or ongoing degradation.

6. Response

From our investigations, we postulate that syncope is a mechanism of protection that lasts a few seconds to minutes. Like involuntary sleep that shuts the body down for a quick revamp and rehabilitation, syncope switches off the entire body system to prevent potential damage from spreading to an irreversible stage [28]. It occurs at a high level of entropy in the body; when the limit of the entropy function tends toward the maximal value, the mind short-circuits the body to mitigate and manage the upcoming or ongoing chaos. As the literature and observation show, syncope is a symptom or a reaction to some underlying conditions; it is not a disease in itself [24, 29]. It responds to an ongoing critical situation in the body systems, a survival tool purposefully designed to prevent premature death. Like a clever engineer sets up a fuse on his electric circuit to protect his appliances in case the current exceeds a safe level, both sleep and syncope are designed to play the role of safety devices in living organisms to handle entropy fluctuation [30]. Could life in living organisms be wisely crafted and designed? [31-33].

7. Conclusion

Living organisms as chemical systems produce entropy which fluctuates over time; thus, the body is equipped with sleep and fainting to control, manage and mitigate this fluctuation. With quantum biology

tools, we distinguish two types of syncopes, and both systemic and punctual syncopes have to do with increasing chaos. Forceful impacts cause punctual syncope, while systemic syncope occurs due to system failure that leads to ischemia and hypoxia.

Both sleep and syncope are reversible and transient losses of consciousness in the body. Natural sleep occurs at the minimal critical value of the entropy (the value corresponding to the onset), while syncope happens at the maximal critical value of the entropy. Future investigations must determine these minimal and maximal critical values at which sleep and syncope occur in the body. Once scientists have established the domain of the definition of the entropy function in the human body and living organisms in general, these values will not be difficult to approximate.

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