



# Understanding the Voluntary and Involuntary Aspects of the Sleep Mechanism

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## Abstract

This article deals with quantum biology, the new tool to complete traditional biology and answer difficult questions about living organisms and human existence. We elucidate the involuntary aspect of the sleep mechanism with the work of Nobel laureate Prigogine on dissipative structures and introduce the concept of spontaneous symmetry breaking; we explain why sleep and syncope are two protective mechanisms to prevent it from occurring in living organisms.

**Keywords:** Dissipative Structures; Complex Systems; Non-equilibrium Systems; Quantum Biology; Entangled System Degradation/Synthesis; Entropy of the Body; Spontaneous Symmetry Breaking

## Introduction

Life is still a mystery; however, with the emergence of modern science, humans have progressively wrested many secrets from Nature to push the boundaries of our understanding of the profound questions of the universe. Sleep remains one of the most profound questions scientists are confronted with today, and like Professor Jim Al Khalili, we believe this conundrum cannot be solved unless we appeal to quantum science. In his 2015 Ted talk, Professor Al Khalili explains how quantum biology is here to explain life's biggest questions [1].

Indeed, the mystery of sleep could never be solved by traditional biology alone; biologists have to rely on quantum science to elucidate the puzzle. Until today, science has no viable hypothesis on why life emerges in material objects, how it is maintained in organisms, and why it finally departs from the physical body, what we call death. Traditional science still struggles to comprehend why living organisms

must sleep and why humans sometimes faint.

Sleep is an evasive topic unless we apprehend it with quantum tools. In our previous articles, we heavily relied on the work of Erwin Schrodinger; most of his speculations in the middle of the last century have become fundamental scientific knowledge today [2]. In this paper, we will introduce the research of Professor Prigogine to encroach further into the mystery of sleep. To grasp the voluntary and involuntary aspects of the sleep mechanism, we need to understand dissipative structures and why living organisms are ones.

Sleep is a mechanism of protection; it is a transient loss of awareness to allow the body to refurbish and revamp its systems. Like a fuse inside an electric circuit, sleep prevents the body from premature death. As we have always said, sleep is a temporary loss of consciousness, while death is a permanent loss of consciousness in the body. Humans gain something to live; they lose it to die, and that thing is not in the mitochondria<sup>1</sup>. This vital energy is yet to be discovered

by Contrary to popular belief, ATP is not the energy but the energy carrier. When energy is needed, the body breaks two phosphate bonds of the ATP molecules. The second and third phosphate bonds release the necessary energy into the system to sustain the activity of cells. Science still does not know what energy is; it studies its manifestation and storage science.

This article will glimpse into the nature of the particular energy that vitalizes the physical body. We will introduce spontaneous symmetry breaking and explain why sleep and syncope are two protection mechanisms to prevent it from occurring in living beings. We will study car engines to make the connection with living organisms and explain why the individual can drop off against his will.

### Living Organisms as Dissipative Structures

Ilya Prigogine was a Russian-born chemist who pursued his scientific career in Belgium. He won the Nobel Prize in 1977 in chemistry with his theory of dissipative structures and complex systems [3]. According to Professor Prigogine, living organisms are dissipative structures that firmly depend on their environment.

A dissipative structure is an open system that exchanges energy and matter with its environment to maintain a relative order within its body systems. For that cause, it sustains entropy and must feed on negative entropy. Like Erwin Schrodinger, one of the founding fathers of quantum mechanics, Prigogine also reached the conclusion that living organisms must supply a sufficient amount of negative entropy flow to maintain an ordered state within their systems [4].

Another fundamental characteristic of dissipative structures is that they experience spontaneous symmetry breaking; that's why all living organisms die. The symmetry-breaking process made Prigogine conclude that all complex systems are irreversible; indeed, they are. Many of the most salient processes in Nature are irreversible, and living organisms are one of them. Living organisms do experience spontaneous symmetry breaking; that's why they die. Thus, to prevent such premature death, several systems of protection are erected in the body; sleep and syncope are two of these protection mechanisms.

Whenever the entangled system degradation/synthesis is threatened, the mind shuts the body down to better control the chaos. Spontaneous symmetry breaking causes the entangled system degradation/synthesis to collapse, leading to the demise of the body. Physicists often define spontaneous symmetry breaking as a perturbation or fluctuation that eventually determines a system's fate. Notice

that the perturbation must be internal to the system to be computed as a spontaneous process.

One of the leading conclusions Professor Prigogine reached with his research is that dissipative structures like humans, for instance, show two types of behaviors: a tendency to a state of maximum disorder and a coherent behavior. How do living organisms manage their high entropy state to prevent a spontaneous symmetry-breaking process from settling in the body? This critical question shall be discussed in the following sections.

### Car Engine and Blown Head Gasket

Nothing is better suited to explain the current question of the involuntary sleep mechanisms in the human body systems than the phenomenon of a blown head gasket that sometimes occurs in cars. Science is about observation and experience, and I learned from this incident just after finishing my emergency medicine class; the experience changed my understanding of sleep.

Everybody knows about the voluntary shutdown of cars. People drive their cars to work, park and shut them down. At the end of the shift, they retrieve their vehicles, drive back home, and shut them down again to use them tomorrow. Very few among the population are aware that the car can shut itself down to protect its engine. This situation can happen during a blown head gasket.

The human body is similar to a car; we eat food, convert it to glucose, and burn it to fuel our muscles. In the process, we generate heat to keep our bodies warm. The car feeds on gasoline and burns it to run the engine and roll. Here also, the process creates heat which the engineer maintains at a specific temperature with a radiator and a thermostat. The engineer circulates a coolant through the engine block to make the heat control efficient. When a blown head gasket occurs, the integrity of the engine block becomes compromised, and one of the consequences is an abnormal surge in temperature. The head gasket sits between the engine block and the cylinder head; it seals the combustion chambers from coolant and oil passages. Thus, when the gasket is compromised, the whole engine will fail, and the heat generated by the combustion will be out of control.

The thermostat will detect the temperature surge and notify the driver with an alarm on the dashboard. If the driver ignores the notice and fails to take action and bring the vehicle to a stop, the thermostat will shut down the engine even against the individual's volition. This scenario also occurs with human beings and living organisms in general. In humans, the mind replaces the thermostat. Thus, when the entangled system degradation/synthesis is threatened due

to an increasing entropy level in the body, the mind will shut down the body against the individual's will. When fatigue is high to a critical level, the mind will shut the body down if the individual fails to act.

Our theory of entropy of the human body stipulates chaos is present inside the physical body of living organisms which manifests as fatigue, diseases, and death. Sleep, therefore, is a mechanism to control chaos in the body; it prevents the increasing entropy from reaching a critical value to induce irreversible damage to the body systems.

Life is about the equilibrium between degradation and synthesis, or to speak more accurately, like the Japanese Nobel laureate Yoshinori Ohsumi, it is a controlled balance between degradation and synthesis [5]. According to Prigogine, living organisms are non-equilibrium systems that generate spontaneous order. Non-equilibrium is the source of order, as he said in the last chapter of his book "Order Out of Chaos." When entropy increases to become maximal, the system reaches equilibrium causing spontaneous symmetry breaking to settle.

This It is important to stress that some processes in living cells reach equilibrium, while others don't. That's why millions of cells could die daily in the body but the individual is still alive. The entire living organism, therefore, is far from equilibrium new situation leads to the demise of the body because the entangled system degradation/synthesis has already collapsed.

We live because the vital energy is greater than the body's entropy. Chaos in living organisms is kept in control and must remain minimal and constant; unfortunately, it never does. Entropy constantly fluctuates; if it were stable and minimal, no individual would sleep. We sleep and faint to mitigate this fluctuation.

## Discussion

Every night, humans and several species of the animal kingdom drop off voluntarily [6]. They do so because they have developed the habit of running their activities by day time, taking advantage of the sunlight. Although nighttime slumber appears to be the best because of the environment's tranquility, we must stress that nighttime sleep is an illusion. Many people beat themselves up by feeling bad when they fail to drop off at night.

Nighttime sleep is a mirage. The proof is that if humans discover a habitable planet outside the solar system and decide to travel, they will not bring the sun along with them; there will be no day nor night, and people will sleep according to their level of fatigue [7]. Living organisms sleep because

of entropy; they all drop off because the entangled system degradation/synthesis threatens to collapse. The mind does not necessarily require eight hours to defuse the threat and bring the body systems to a relative equilibrium until the next threat reappears. People who nap will understand what I mean here.

The story reports that Leonardo Da Vinci maintained a polyphasic sleep pattern throughout his lifetime; he slept 20 minutes every four hours. While this statement is difficult to verify, we do, however, have a well-documented record that Nicolas Tesla used one to two cycles to bring entropy in his body under control [8]. The famous inventor explicitly stated on page 14 of his autobiography the following:

"I regularly started my work at three o'clock in the morning and continued until eleven at night, no Sundays or holidays excepted."

The game with sleep is to know the entropy of one's body systems and how to manage it efficiently. To do so, one must differentiate between sleep and rest; they are not the same things. One is a protective mechanism, while the second is a therapeutic mechanism. Thus, how to heal the body after a hard day of work can never be the same for everybody.

Based on the work of Prigogine on dissipative structures, one must understand that the best way to maintain order in the body of living organisms is to keep the entropy at a minimum level at all times [9]. What does this mean? Whenever the individual is not busy doing anything fruitful or positive with his life, he must be resting. The human body is designed for work; thus, when the body is not working, it must be at rest.

According to the National Safety Council, drowsy driving accounts for about 100 000 crashes yearly in the United States, showing that people are not resting well enough. If the body does not have proper rest, the mind will be obliged to shut the system down against the individual's will. That's what often happens to people behind the wheel of their vehicles; they fall asleep and crash.

The individual is more likely to experience an involuntary shutdown when he has no proper rest in his previous sleeping patterns. People are not having enough rest because sleep's purpose and nature escape human understanding. Night sleep is a thing, but it is an illusion. Whether the individual sleeps by day or night, he that fails to get proper rest will experience an involuntary shutdown at a certain point.

The population has a cult-like mentality that we must sleep 8 hours every night to be healthy. People should be preoccupied with how rested they are instead of how long

they have been in bed, whether day or night. One can sleep more than 8 hours and not get proper rest [10].

The population must stop worrying about sleep for three simple reasons: first, they don't understand this mystery, and second, the sleep process has several cycles, each almost autonomous [11]. Third, the human body is a complex system, meaning there cannot be an accurate standard model to describe its functioning. Every human is unique, and the sleeping process varies drastically across ages and gender. The observation also shows daytime sleepiness increases in women during pregnancy, especially in the early months.

The paramount goal of sleep is the restoration of the body systems. Most humans reach that goal within 8 hours; some animals refurbish their systems with less than that, while others spend almost 90 percent of their existence in that lethargic condition. Every group is trying to maintain its entropy minimal and constant to prevent spontaneous symmetry breaking from occurring in their body systems.

## Conclusion

We don't always control our sleep patterns; the phenomenon is so elusive that it goes unnoticed in our quotidian lives. Often, we go to bed with a strong desire to drop off. However, there are cases where we don't want to fall asleep, yet we end up drowsy and drop off. The consequence of such an involuntary act is often dramatic; it leads to death or serious injuries, especially when the individual is busy with machinery or behind the wheel of a motor vehicle [12-14].

Everybody wants to go to bed at night and have a deep and restful sleep; nevertheless, as we age, falling asleep and getting a restful slumber tend to be an assault course; this is so because living organisms are dissipative structures. As we exchange energy and matter with our environment, we generate entropy which tends to increase over time. More chaos means more disruption in the functioning of our systems. Notice that life challenges also augment with age putting more stress upon the mind, which fails to shut the body down efficiently as it used to when we were young. Since we are also complex systems, the gradual failure of the mind in its duty as a "thermostat" will lead entropy to prevail sooner or later, and the body systems will definitely shut down one day: it is called death [15-19].

Involuntary sleep is the next step before syncope or death; it prevents irreversible damage to the body systems as the individual fails to act and curb his fatigue. It often lasts a few seconds to minutes, a quick system fix in an emergency situation that usually passes unnoticed [20,21]. The individual could avoid it with an anticipated five to

ten minutes nap. Unfortunately, people underestimate the healing power of a nap [22].

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