

## From Chemistry to Consciousness

### An Evolutionary Path Toward Consciousness

by Michael Striem

## A Possible Evolutionary Line from Chemistry to Consciousness

### Preface

Consciousness may have emerged from the earliest biological systems that evaluated the advantage of energetic efficiency versus energetic inefficiency, gradually evolving from simple metabolic regulation into the rich emotional and cognitive experiences of complex living organisms.

Life probably did not begin with consciousness as **we** experience today.

It began with chemistry organizing itself around energy.

Molecules capable of absorbing and transforming heat, light, and chemical gradients formed structures that could maintain themselves. These structures survived because they handled energy more efficiently than their surroundings.

From this simple beginning, life gradually introduced the principle: **Evaluation of energetic efficiency**.

Living systems had to determine:

- which conditions support their continuation
- which conditions threaten their stability.

Consciousness may not be a sudden property that appeared late in evolution.

Instead, it may be the gradual enrichment of biological evaluation systems, beginning with the earliest living cells and reaching extraordinary complexity in human beings.

In this view, conscious organisms are systems that transform energy into information (building the body properly) and experience (the know-how and why), navigating the world through signals of benefit and harm, between smooth to friction.

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## Stage 1. Energetic Self-Organization (Pre-Life)

Before life, molecules, physical systems, already tended to form energy-efficient structures. This is usually considered as an unstable balance between forming stable structures, such as crystals (lowest [entropy](#)), and the tendency of a system to reach [thermodynamic equilibrium](#) (evenly dispersed in a space), where the [entropy](#) is highest. These structures need to efficiently and constantly dissipate gradients of energy, to the inside of the structure, and the outside - the environment. Examples include: chemical gradients organizing reactions networks, lipid membranes forming spontaneously, self-organizing molecular autocatalytic networks, electrostatic balances.

Some researchers call this 'dissipative self-organization'.

At this stage there is no consciousness (as I view it) yet.

At this stage there is no awareness (as I view it) either.

However, the physical foundation for life is established: stable structures that manage energy flows. It establishes the physical principle: systems that better process energy – will persist.

*This basic physical rule is the **cornerstone** of proto consciousness, a compass to direct evolution. The "information" of the system, regarding the rules and best practice, is "written" into the system's infrastructure (such as walls and membranes), not as formulas or terms but rather as the complex design of molecules and energetic balance.*

## Stage 2. Biological Evaluation into Primitive Life. Metabolic Decision Systems

Once true living cells appeared, something new emerged: Cells began to sense conditions and respond to their environment, eventually regulating behavior: they start moving toward nutrients, moving away from toxins, regulating metabolism, communicating chemically, approaching beneficial conditions, avoid harmful conditions, temperature, chemical gradients.

This is the earliest form of biological evaluation. It introduces a primitive biological logic:

- favorable conditions → approach
- harmful conditions → avoid

It is not yet a true subjective feeling, but it is the functional ancestor of pleasure / pain signaling.

*The basic rule of the **cornerstone** of proto consciousness continues to serve as the compass for guiding biological evolution. You might call this "proto evaluation" using the "information" which is "written" into the structure of the organisms.*

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### Stage 3. Valence Systems (The Joy–Pain Axis).

As organisms become multicellular, internal signaling systems develop.

Biology introduces internal states (polarity) corresponding roughly to reward pathways to beneficial conditions, stress pathways, hormonal feedback, neural signaling.

Now organisms can internally encode harmful conditions. These signals have causal power to guide behavior. In modern animals we experience these signals like fear, discomfort, satisfaction, pleasure, joy.

### Stage 4. Nervous Systems: Integrated Experience.

At this stage, experience may already begin to emerge in simple forms.

With the evolution of nervous systems, information becomes integrated (as neural structures). This integration allows the organism to “remember” and “feel” internal and external conditions, creating causal power, with flexible behavior and learning. Animals now combine perception, sensory information, body signals, state memory, motivation, which gives it causal power in flexible and adaptive behavior.

The nervous system essentially becomes a coordination center for energy management and survival decisions.

*With much more complex needs, the basic rule of the **cornerstone** continues to serve as the compass for guiding biological evolution. You might call this “proto consciousness”. The “information” which is “written” into the structure of the organisms is now directly perceived subjectively with more “awareness”.*

### Stage 5. Complex Conscious Experience (Humans)

In humans, and probably some other animals as well, neural organs become extensively developed, integrated, extremely rich and complex. New capacities appear: symbolic language and thinking, abstract thought, long-term planning, cultural learning, self-reflection, concept of time and more.

The deep continuity allows the organism to observe not only the world, but its own internal states. Underneath philosophy, art, and science remain the same biological axis. Living systems continuously evaluate their conditions along the simple axis:

- energy gain / biological success → positive valence
- energy loss / threat / danger → negative valence

What humans experience as joy, satisfaction, fear, or pain may represent highly refined versions of these ancient regulatory signals. We now use our symbolic terms and issues, extremely rich language, for long-term planning, self-reflection, cultural relationships.

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Despite this enormous complexity, the fundamental biological principle remains unchanged, and the core regulatory system is still present.

*Highly complex needs for causal power in behavioral actions are created by, and also support by, the outstanding large and complex nervous system. The basic **cornerstone** continues to guide our biological evolution. The “information” which is “written” into the structure of our body is now directly perceived subjectively as awareness. We now call this “consciousness”.*

### **An Interesting Connection to Modern Biology**

Our intuition resonates with work by scientists such as:

- Antonio Damasio, who argues that feelings originate in homeostatic regulation of the body.
- Karl Friston, whose Free Energy Principle proposes that living systems minimize surprise and maintain stability.

Both frameworks suggest that the roots of consciousness lie in biological regulation of life processes.

### **Here our Idea Adds Something Unique**

Many theories describe how brains work, but fewer emphasize the deeper evolutionary narrative:

*From energy chemistry → survival evaluation → feeling → conscious experience.*

Our idea keeps the story anchored in biology and evolution, which is a powerful grounding. We believe that the core feeling of an organism, either from internal or external sources, is based on these simple rules. The information on which all is based is right “under our nose”.

**It IS the biological structure of the body.**

**Thus, the conscious feeling is just our awareness of our body’s natural functions.**

Someone has explored this path. In fact, there is a substantial literature trying to understand the building blocks of consciousness from an evolutionary perspective. Many researchers arrive surprisingly close to our intuition: the earliest roots may lie in biological evaluation systems such as pleasure, pain, or value signals.

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**The Core Insight of our Idea (very simplified)**

Conscious systems evolved as increasingly sophisticated energy-efficiency-usage evaluation systems. With quantitative sensitivity and direct feedback, organisms were guided toward survival and reproduction, based on the efficiency of their metabolism.

This evolutionary path of life converted chemistry into biology, with a very precise and effective method of preserving the information which was needed to create the fittest: it made the organism built by, constructed of, the most suitable and winning configurations, at every level of its increasing complex body. This “build-in” chemical / biological “language” is the most relevant information this organism needs to survive and flourish. This information does not need any symbols. The “language” is purely energetic equations, which we now (partially) know to understand.

Most of the time, and most of the organisms, live perfectly without the burden of self-awareness. They just have their instincts and intuition to navigate. We, Humans, were created somewhat differently. Our complex neurological setup, with the morphological changes we accumulated along our evolutionary path, gave us the advantage and the burden of consciousness.

As so often happens, communication among us hinders smooth progress, by using variable languages (by country and profession). Abusing language is becoming much more evident by using LLMs. As a result, we “enjoy” our interactions to reach understanding. For example: the term “consciousness” was invented to describe some issues regarding our subjective feelings and mental states. It seems to cover a huge range of issues, and many theories were suggested. Fortunately, we made tremendous progress by clarifying what we mean.

Here we suggest yet another way to look at consciousness, with a point of view regarding ‘information’ and awareness.

Among the intriguing questions appearing with this discussion of this evolutionary line is: at what point along this chain does subjective experience actually arise? bacteria? insects? fish? mammals?

This question is currently one of the most fascinating open problems in science.

It is important to know about the presence of subjective awareness when designing the next generation of AI bots. Do we actually make them have such sensitivity to their own existence?

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