

A Novel Theory of Life and Its Implications on Future Robots and AI

Dr Yunus Çengel

MARCH 2025

doi.org/10.33548/SCIENTIA1234



LIFE SCIENCES & BIOLOGY

 Scientia





Is Life an Emergent Property or a Purposeful Agency?

Despite our increasing scientific understanding of biological processes, the fundamental nature of life itself remains one of science's most profound mysteries. While we can easily recognise living things, defining precisely what makes something 'alive' has proven remarkably challenging. Dr Yunus Çengel from the University of Nevada is pioneering a radical new way of thinking about life – not as an emergent property that arises from complex chemical systems and passively qualifies matter, but as an 'agency' that actively controls and governs matter, much like the laws and forces of physics that govern the physical world as the 'agency of physics'.

Life's Persistent Mystery Challenges Scientific Understanding

Throughout history, humans have been fascinated by the distinction between living and non-living things. A stone and a living cell may contain similar atoms and molecules, but the cell exhibits purposeful behaviour that cannot be attributed to the laws and forces of physics. This mystery has only deepened as our scientific understanding has advanced.

The challenge of defining life has led to numerous attempts to characterise it through observable features like reproduction, metabolism, growth, and response to stimuli. However, as Dr Yunus Çengel of the University of Nevada points out, these definitions invariably fall short. A mule (donkey-horse hybrid) cannot reproduce but is clearly alive, while viruses can replicate but are often considered non-living since they depend entirely on host cells for metabolism.

Even more fundamentally, listing characteristics of living things does not actually explain what life itself is. Doing so is like describing the effects of gravity without understanding gravity as a fundamental force. Dr Çengel argues that we must look deeper to understand life's essential nature, which means going beyond merely cataloguing the common physical features of living beings.

A practical approach to the inquiry of life is to contrast living beings with non-living ones and extract the distinctive features of living beings. When living beings are carefully examined, the characteristics of life appear to be *existence, subjectivity, agency, purposiveness, primacy and supremacy, naturalness, field phenomenon, locality, transience, transcendence, simplicity, unicity, initiation, information processing, a set of traits, code of conduct, hierarchy and nesting, and the aptitude to vanish*. Among them, the crown jewel is the agency aspect of life. These characteristics constitute a reasonably comprehensive set of features to distinguish living beings from non-living ones and contrast chemistry with biology. However, the enigma of life remains.

A Novel Definition of Life

The universal laws of physics are inferred phenomena that originate from the observed regularity in the physical realm. An apparent distinct feature of living beings compared to non-living ones is the presence of a higher level of regularity, which is indicative of a supplemental set of governing laws within the sphere of life. Dr Çengel defines a living thing as *a natural entity whose internal changes and external behaviour cannot be predicted by the universal laws and forces of physics alone at all times*. Everything else is non-living or inanimate. Likewise, he defines life as *a supplemental set of laws and influences that act over a confined space which constitutes the domain of life, superimposed on the universal laws and forces of physics*.

This definition can be visualised by comparing the behaviour of a live fish to that of a dead one. Apparently, the supplemental set of laws and influences associated with life are at work in the live fish but not in the dead one. The behaviour of a dead fish in a river can be predicted precisely by the laws and forces of physics alone at all times. However, this is not the case for a live fish since its behaviour cannot be predicted by the laws and forces of physics. Therefore, the live fish and the dead one are like two different universes with two different sets of governing laws and forces.

Life as an Active Controlling Agency

Dr Çengel's theory suggests that life is not an emergent property that simply appears when matter is organised in a way hospitable to life. Instead, he argues that life is a fundamental aspect of reality. This invisible but active agency can take control of suitable arrangements of matter and direct them toward specific goals. This perspective helps explain why living things exhibit such remarkably different behaviour from non-living things, even when their chemical composition is identical.



According to Dr Çengel, the difference between living and non-living entities is the presence or absence of this controlling agency of life.

The new view of life may help us settle the debate on whether a virus is alive or not. When outside of a host cell, a virus is inactive, just as the seed of a plant is dormant. But when a virus enters a host cell, it seizes the host cell's machinery and directs it to produce copies of its own genetic material and viral proteins. These acts characterise a virtual mechanism that resembles an agency. Therefore, a virus appears to be more than a sack of chemicals that include a DNA or RNA molecule, and that a virus qualifies as a lifeform by the definition given above. Lifeless chemicals cannot perform biological functions. Viewing a virus as inanimate is equivalent to reducing it to a pack of inept chemical molecules. Dormant lifeforms and inanimate things cannot be given equal status since the former comes alive under the right conditions, whereas the latter remains lifeless under all conditions.

Understanding Agencies versus Properties in Nature

To appreciate Dr Çengel's perspective, it is essential to understand the fundamental difference between properties and agencies in nature. Properties are passive characteristics that emerge when physical components are assembled in certain ways. For instance, when hydrogen and oxygen atoms combine to form water molecules, new properties emerge – such as surface tension, the ability to dissolve other substances, and specific freezing and boiling points. These properties happen automatically, and they do not actively control or direct anything, they simply qualify matter.

In contrast, agencies are entities that can manipulate and control matter. The laws and forces of physics are prime examples, as they actively determine how physical objects behave rather than just describing their properties. Gravity does not simply emerge from matter; it actively influences how matter moves and interacts. Dr

Çengel argues that life belongs in this category of active agencies rather than passive properties. Like the forces of physics, life appears to actively direct and control matter rather than simply being a characteristic that emerges from complex chemical systems.

Simple Examples Reveal Life's Agency in Action

Dr Çengel uses several clear examples to illustrate his theory. Consider what happens when water enters a living body – it becomes incorporated into biological processes and behaves in ways that cannot be predicted by chemistry and physics alone. The water molecules appear to be actively directed by life toward specific purposes. When that same water leaves the body as sweat, it returns to behaving according to normal physical and chemical laws. This example shows how matter can transition between being under the control of the agency of life and being governed solely by the laws of physics. The water molecules themselves do not change – what changes is whether they are under life's influence.

Another compelling example involves DNA – the molecule that carries genetic information. While scientists can artificially construct DNA molecules in the lab that are chemically identical to natural DNA, these synthetic DNA molecules remain inert unless placed within a living cell. Something about the living cellular environment – which Dr Çengel argues is the agency of life – activates the DNA and enables it to direct biological processes.

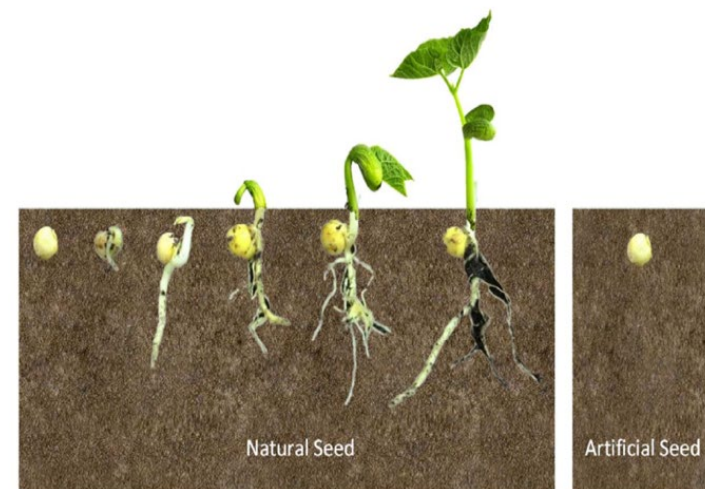
Perhaps the most compelling evidence comes from comparing natural and artificial seeds. A natural seed contains DNA and other molecules arranged in exactly the same way as an artificial seed that scientists might construct. Yet when planted, only the natural seed springs to life and grows into a plant. The artificial seed, despite having identical chemistry, simply decays. This observation strongly suggests that life cannot be reduced to just the proper arrangement of chemicals.

There must be some agency – the agency of life – that inhabits natural seeds but is absent from artificial ones. No matter how perfectly the chemical structure of a seed is replicated, life cannot be created from non-life.

Understanding Life as a Field Phenomenon

Dr Çengel draws an interesting parallel between life and quantum fields in physics. Quantum fields are virtual mechanisms that permeate space and give rise to fundamental particles with a set of specific properties. Similarly, life could be viewed as a field phenomenon that can manifest in suitable arrangements of matter. However, unlike quantum fields (which extend throughout space), the field of life appears to be localised within living organisms. This helps explain why life's influence is bounded – it only affects matter within living things, not all matter everywhere. This field perspective also helps explain how life can maintain coherent control over entire organisms. Just as a magnetic field can align countless iron particles into a cohesive pattern, the field of life might coordinate the countless molecules within a living being toward coherent purposes. When life disappears, the sophisticated physiological processes in living beings come to a halt.

All constituents of a living being, including the genome, are inherently lifeless when extracted out of the living being. When a virus is disassembled into its constituents, for example, the elusive life disappears. When the constituents are reassembled with precision so that the assembly perfectly resembles the original virus, life never reappears, and the assembled virus never exhibits purposeful behaviour. It just stands there as a pile of physical components. Therefore, the notion that the assembled constituents suddenly acquire life out of nowhere is far from being factual. The common observation that life emerges only from life and never from non-life supports the argument for the existence of enigmatic life.



- ▲ A natural (live) plant seed with healthy DNA buried in moist soil germinates and sprouts. But the exact artificial (lifeless) replica of it with the same healthy DNA buried in the same soil does not.

Information Processing Without Conscious Control

One of the most remarkable aspects of life is its ability to process information and behave like a knowledgeable and capable entity. Even the simplest single-celled organisms act like fascinating sophisticated chemical factories. Dr Çengel argues that this information processing capability is another indication that life is an active agency rather than a passive property.

While computers can also process information, they require conscious beings to program them and interpret their outputs. In contrast, living things process information automatically as part of their nature. This suggests that information processing is an intrinsic aspect of the agency of life rather than something that emerges from complex chemistry alone.

Implications for Understanding Consciousness and Free Will

Dr Çengel's theory has interesting implications for understanding subjective qualities such as consciousness and free will. If life is an active agency that can direct matter, then consciousness might be viewed as a higher-order manifestation of this same agency in higher organisms with advanced nervous systems. This perspective suggests that consciousness and free will might be fundamental aspects of life rather than emergent properties of complex brains. While controversial, this view could help explain the problem of consciousness – how subjective experience arises in higher forms of life.

This theory is highly relevant to the future possibilities of creating artificial life or conscious robots. If life is an active agency rather than an emergent property, as postulated here, then arranging matter in increasingly complex ways will never spontaneously

generate life or consciousness. Just as we cannot create new laws of physics, we likely cannot artificially create the agency of life since life is a set of complementary laws and influences. This suggests that future robots will remain fundamentally different from living beings no matter how sophisticated their programming becomes. While they may be able to simulate life-like behaviours, they would lack the actual agency of life that actively directs living organisms toward purposeful goals. The theory also suggests we should be sceptical of claims that artificial intelligence will eventually become conscious or develop genuine emotions. These qualities may be fundamental aspects of life's agency rather than computational properties that can be replicated artificially.

Challenging Questions About the Nature of Life Itself

Dr Çengel's work raises some fascinating questions about what life fundamentally is. He argues that viewing life as an agency provides a more accurate framework for investigating it than seeing life as merely an emergent property. Dr Çengel's work suggests we need to rethink traditional approaches to defining life. Rather than focusing on observable characteristics like reproduction and metabolism, we should look for evidence of active agency – signs that matter is being directed toward purposeful ends rather than simply following physical and chemical laws.

The theory also suggests new ways of thinking about controversial cases like viruses. Rather than debating whether viruses have enough life-like properties to qualify as living things, we could instead ask whether they show evidence of being controlled by the agency of life. Their ability to hijack cellular machinery and direct it toward viral reproduction suggests they do possess this agency, even if they lack some traditional characteristics of life.

Testing the Theory's Predictions

The hallmark of a successful scientific theory is its ability to make predictions in addition to explaining the observed natural phenomena. Based on the propositions that 1) life is a field phenomenon and comes with a set of laws, influences, and qualities that vary considerably from species to species and 2) certain qualities like consciousness, emotions, and desires are observed only in living beings and never in non-living entities, the new theory of life predicts that no machine will ever gain consciousness, emotions, etc. unless they acquire life first. Considering that the essence of life is a set of laws and influences that act within the domain of life, the likelihood of artificially creating life from scratch is no higher than artificially creating a new law of physics and the influence that accompanies it.

The theory also predicts that attempts to create artificial life by purely chemical means are unlikely to succeed since, despite their abundance, chemical reactions have never produced life. Apparently, the difference between chemistry and biology is the enigmatic life. The theory suggests that studying how the agency of life interacts with, and controls matter may be more productive than trying to reduce life to chemical processes alone. Understanding this interface could have important implications for medicine and biotechnology. This perspective might help bridge some traditional divides between ontologically objective and subjective realms.

Without the laws and influences of life that prevail in the animate realm, all that the mere laws and forces of physics can do in the inanimate realm are the purposeless accumulations and rearrangements of matter with arbitrary shapes, like the hills and valleys of sand in Death Valley. All observed goal-oriented acts and artefacts, whether natural or human-made, are associated with the agency of life. While many mysteries about life remain, Dr Çengel's innovative perspective opens new avenues for investigation and challenges us to think differently about one of science's most fundamental questions. By viewing life as an active agency that controls matter rather than a passive property that passively qualifies matter, we may finally begin to make progress in understanding this most enigmatic aspect of our universe.

MEET THE RESEARCHER

Dr Yunus Çengel

Professor Emeritus of Mechanical Engineering, University of Nevada, Reno, NV, USA



Dr Yunus Çengel is a Professor Emeritus at the University of Nevada, Reno, USA. He received his PhD in Mechanical Engineering from North Carolina State University and served as a faculty member at the University of Nevada, Reno, since 1984. He was the Director of the Industrial Assessment Center and served as a consultant in the areas of energy efficiency, renewable energy, and energy policies. Dr Çengel is the author or coauthor of several widely adopted engineering textbooks such as *Thermodynamics: An Engineering Approach*, *Heat and Mass Transfer: Fundamentals and Applications*, and *Fluid Mechanics: Fundamentals and Applications*, all published by McGraw-Hill. He has published many scholarly articles and developed novel theories on life and information. He has delivered numerous keynote and invited lectures at technical conferences and academic institutions. He has received the ASEE Meriam/Wiley Distinguished Author Award for excellence in authorship twice. In 2022, he was inducted into the Hall of Fame in Mechanical Engineering at North Carolina State University.



CONTACT

yunus.cengel@yahoo.com



University of Nevada, Reno



FURTHER READING

YA Çengel, *Life: An emergent property that passively qualifies matter or a purposive agency that actively controls matter?* *Journal of Future Robot Life*, 2024, 4(1-2), 31-50, 2024. DOI: <https://www.doi.org/10.3233/frl-230004>

YA Çengel, *Eighteen distinctive characteristics of life*, *Heliyon*, 2023, 9(3), E13603. DOI: <https://doi.org/10.1016/j.heliyon.2023.e13603>

YA Çengel, *A Novel Theory of Life and Its Implications on Viruses and Robots*, *Journal of Future Robot Life*, 2022, 3(2), 183-205, 2022. DOI: <https://www.doi.org/10.3233/FRL-210011>



Find out more at **scientia.global**