Funding the Future

Article URL

Published: January 12, 2026, 5:18 pm

Background

Having finished the first series that I plan to publish on quantum economics (others are planned), it became clear that explaining the use of this thinking was important before moving on to further ideas. The result was a new series, called The Quantum Essays. Previous posts are listed at the end of the post.

Like other essays in this series, this one developed out of a conversation between my wife, Jacqueline, and me, who has read more of Schrödinger's work than I have. I take responsibility for the final drafting.

I hinted last weekend that we had developed three ideas for blog posts during a Saturday morning coffee break while birdwatching. Two have been published. This one required more thought and another Saturday morning coffee break, a week later, to discuss further reading and complete it.

A list of essays in this series, which explore ideas flowing from my first series on quantum economics, is to be found at the end of this essay.

Schrödinger, entropy, equilibrium, and the lessons for society

"How does the living organism avoid decay? The obvious answer is: by eating, drinking, breathing and (in the case of plants) assimilating. The technical answer is: by continually importing negative entropy."

Erwin Schrödinger, ***What is Life?*** (1944)

That deceptively simple line from Schrödinger's wartime book, based on a lecture series, changed how we think about life. It was not just a biological remark. It was a profound statement about physics, order, disorder, and what it takes to resist the natural tendency of things to fall apart. What Schrödinger noticed, and others later formalised, has significance far beyond biology. It has implications for how we understand economies, societies, and the political choices we face now.

The problem Schrödinger confronted

The second law of thermodynamics states that entropy - the measure of disorder - never decreases in a closed system. Left alone, systems move to equilibrium, which is, ***as was explored earlier in this series, the maximum possible entropy state, where no further change is possible. For living organisms, this is, quite literally and ultimately, a death sentence.***

However, if entropy always rises, the second law of thermodynamics implies life ought to dissolve into disorder. But it doesn't. Living systems maintain extraordinary order despite what the law implies. Cells replicate. DNA faithfully transmits information. Human beings repair and renew themselves every day.

Schrödinger's genius was to see the paradox: life is not exempt from the second law, but nor is it describable by the physics of equilibrium. He asked how do organisms keep themselves ordered in a universe tending toward disorder?

Schrödinger's answer: negative entropy

Schrödinger coined the phrase ***negative entropy***, or "negentropy", in answer to this question. By this, he meant that life maintains its order by importing order from outside. We eat food, which is itself the stored order of sunlight captured by plants. Plants, in turn, draw order from solar radiation.

In other words:

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Death is a state of equilibrium, the point of maximum entropy.

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Life is, however, a steady state, held far from equilibrium.

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This steady state is maintained by consuming flows of low-entropy energy and matter.

The consequence is that living systems are open systems. Life cannot be understood in isolation. It must be understood in relation to its environments, and to the energy flows that pass through them.

Order from order

Schrodinger's suggestion was not, however, the final word on this issue. He acknowledged he did not present a complete theory on these issues. To achieve that, I gather that the physics concept of ***Boltzmann's statistical interpretation*** ***had to be challenged.***

As I understand it (and I may be wrong), that interpretation sees order as something that arises out of disorder, with improbable local fluctuations producing ordered patterns, but only temporarily. Schrödinger's argument was that this is not how life is. He argued that life transmits order from order. Hereditary material, he suggested, must be a structure stable enough to carry information, but irregular enough to encode variety. Doing so, he did, apparently, anticipate the structure of DNA.

The consequence is that in Schrödinger's framing, life is not a paradoxical exception to physics but a manifestation of it: a system that avoids equilibrium by drawing order from its surroundings, even if it exports entropy as a consequence of achieving this goal of sustaining life within that wider disorder.

Prigogine and dissipative structures

That then led me to read about the work of Ilya Prigogine, whose ideas seem to build on Schrödinger's in crucial ways.

Prigogine, who was awarded the Nobel Prize in Chemistry in 1977, developed what became known as ***non-equilibrium thermodynamics***. As I read it (and again, I stress, I may be wrong), his central claim was that systems which exist far from equilibrium — where there is constant energy flow in and out — can sometimes organise themselves into what he called ***dissipative structures***.

These are patterns of order that arise not in spite of disorder, but ***because*** of it. Examples include rhythmic chemical oscillations and the coherence of a laser beam. In each case, energy flows through the system, and instead of breaking it down, the flow generates a kind of dynamic stability.

His key ideas, as I understand them, are these:

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Energy flows can create order rather than destroy it. Far from equilibrium, systems can spontaneously organise themselves into stable or recurring patterns.

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The second law of thermodynamics still holds: overall entropy increases. But local order is maintained because the system exports its disorder elsewhere.

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Life itself can be seen as such a structure — one that maintains internal order by

dissipating energy into its environment, much as Schrödinger suggested through his idea of “negative entropy.”

In this light, Schrödinger’s notion of ***importing order*** becomes, in Prigogine’s language, a process of ***exporting entropy***. Living systems, including societies and economies, stay organised only so long as energy, resources, and information continue to flow through them.

I would not pretend to be any sort of master of the physics of this. But the conceptual bridge this seems to offer, between the physical, the biological, and the social, feels immensely important. It suggests that order is not accidental, nor is it ever static; it is sustained only through continual movement, exchange, and transformation, all of which are characteristics of life.

The significance of Schrödinger and Prigogine

What, then, is the significance of Schrödinger’s insight, as deepened by Prigogine?

First, it shows that equilibrium is not the state of life. Equilibrium is death.

Second, it shows that order is not an anomaly. It is a natural consequence of energy flows through open systems.

Third, it makes clear that sustainability requires constant renewal. A steady state is not stasis. It is a dynamic balance, maintained only by constant throughput.

And fourth, it highlights fragility. Remove the flows of negentropy, for example, by cutting off energy or destroying ecological cycles, and life collapses into equilibrium.

Lessons for economics and society

Why does this matter beyond physics and biology? Because economies and societies are also nonequilibrium systems. They, too, maintain complex organisation by exchanging flows of energy, resources, and information with their environment.

Yet mainstream neoclassical and neoliberal economics use equilibrium as their central metaphor: supply equals demand, markets clear, growth balances savings and investment, and so on. The models are built around stability at rest.

Schrödinger and Prigogine, however, teach us something different:

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Equilibrium is collapse, not stability.

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Order requires constant input of energy and information.

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Systems thrive only far from equilibrium, in dynamic states.

This is precisely what we see in real economies: constant change, renewal, and disruption. But unlike natural systems, economies are governed by human choice. We can structure them to sustain order or to collapse into disorder.

Policy implications

Several lessons flow from this (and the agony of trying to understand the ideas that lead to these conclusions).

First, resilience requires energy flows. Austerity is a policy of shutting down energy flows by reducing public investment, suppressing wages, and cutting welfare. It drives economies toward equilibrium, which in social terms means stagnation and collapse.

Second, sustainability requires entropy management. We cannot pretend that infinite growth is possible on a finite planet. Entropy is exported outward, into ecosystems. If the environment cannot absorb it, collapse follows. Schrödinger's insight warns us that living systems cannot survive if the wider environment is destroyed. We have to manage climate change.

Third, information is central. Just as DNA transmits order, societies depend on accurate information flows: free media, honest statistics, transparent government. Corruption, propaganda, and secrecy all degrade the information entropy balance, pushing society toward disorder.

Fourth, justice is essential. Inequality is a form of internal disorder. It corrodes the steady state by concentrating flows of energy and resources in one part of the system while starving others. A healthy society, like a healthy organism, requires balance across its parts.

From physics to a politics of care

Schrödinger did not claim to have explained life in full, but he reframed the problem. Life is not a miracle outside physics. It is physics, but physics far from equilibrium.

The same reframing is needed in economics and politics. We cannot model society as if it tends naturally to equilibrium. We must understand it as a system of energy, information, and care, constantly in need of replenishment.

That replenishment cannot be left to chance. It must be actively organised, through public services, welfare states, environmental stewardship, and democratic participation. These are the social equivalents of "feeding on negative entropy." They are how we maintain order, coherence, and the possibility of renewal.

Neglect them, and collapse follows.

Conclusion

Schrödinger’s insight into entropy and equilibrium was not a footnote in physics. It was a window into the conditions of life itself. Prigogine’s work showed that order is a lawful consequence of energy flows, not an exception. Together, they gave us the intellectual tools to see life - and by extension, society - as systems that survive only by sustaining themselves far from equilibrium.

The lesson is stark. To cut off the flows that sustain us, of energy, of information, of justice, of care, is to invite collapse into entropy. To maintain them is to preserve the fragile but precious order of life.

Economics and politics must recognise this. Schrödinger’s question, “What is life?” is also our question: ***What is the life of society, and how do we sustain it?***

The answer is clear: by importing order, by renewing flows, by resisting the false comfort of equilibrium. Life is not rest; it is the continuous, dynamic struggle against entropy. The challenge of our age is to organise that struggle in the interests of all.

Other essays in this series:

* ***The Quantum Economics series*** ***(this link opens a tab with them all in it)***
* ***The Quantum Essays: Observing and Engaging***
* ***The Quantum Essays: Quantum MMT: The wave function of sovereign spending***
* ***The Quantum Essays: Is equilibrium only possible in death?***
* ***The Quantum essays: Economics, the Big Bang and Rachel Reeves***
* ***The Quantum Essays: Quantum economics, discounting, and the cost of inaction***

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