# Nested Evolution in Microgravity: A Radial Thermal RNA Ecology in Supercritical $CO_2$

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24 Jul 2025 17:00 GMT+8

This concept outlines an original experimental model in which a spherical volume of supercritical $CO_2$, suspended in microgravity, houses hydrogel-encapsulated RNA-rich water droplets. A centrally positioned heat source induces radial thermal gradients, creating evolutionary zones within the sphere. The model serves both as a synthetic ecosystem for prebiotic chemistry and a metaphor for consciousness, spacetime relativity, and epistemological limits. It has potential applications in synthetic biology, complexity theory, and cosmological modeling.

# Technical Overview

## Materials and Components

- **Supercritical $CO_2$ Sphere**
  A transparent, sealed chamber containing carbon dioxide maintained at supercritical conditions (above 31°C and 73 atm). In microgravity, the $CO_2$ forms a spherical, free-floating “ghost bubble” serving as the experimental container.

- **Hydrogel Shells**
  Soft, semipermeable hydrogel spheres (e.g., alginate, agarose) encapsulate water-based microenvironments. These serve as compartmentalized incubators, structurally resembling proto-cells.

- **RNA-Seeded Water Droplets**
  Inside each hydrogel shell are one or more water droplets containing short RNA sequences capable of limited self-assembly, folding, or replication. Each droplet functions as a self-contained experimental micro-ecology.

- **Central Thermal Core**
  A suspended heating element (e.g., micro resistive heater) is placed at the center of the $CO_2$ sphere. It emits controlled, pulsating heat waves, creating radial thermal gradients throughout the system.

- **Microgravity Environment**
  Conducted aboard the ISS or a similar orbital platform, microgravity allows full three-dimensional suspension and motion of all elements without sedimentation or buoyancy-driven distortion.

# Scientific Objectives

This model is designed to explore fundamental questions about evolution, emergence, and environmental influence in closed, isolated microcosms.

- **Thermal Gradient Evolutionary Zoning**
  Assess how proximity to a central heat source affects RNA replication, mutation rate, and molecular stability across droplets at varying radii.

- **Radial Selection Pressures**
  Determine whether spatial positioning creates distinct evolutionary pathways, simulating environmental niches in a spherical ecosystem.

- **Droplet Drift and Dynamic Feedback**
  Study the motion of droplets in response to thermal gradients and $scCO_2$ convection, observing how physical movement affects biochemical change.

- **Compartmentalized Prebiotic Behavior**
  Test whether hydrogels can maintain sufficient environmental stability to support sustained RNA activity, potentially modeling early protocell behavior in a novel medium.

- **Inter-droplet Transfer Effects**
  Introduce RNA strands from “hot” (fast-evolving) zones into “cold” (slow) zones and vice versa to simulate environmental dislocation and track adaptation, dormancy, or regression.

# Applications

This system offers concrete value across multiple domains:

- **Synthetic Biology**
  Enables study of non-surface-bound protocells and evolution in a 3D radial gradient — previously unexplored conditions.

- **Origin-of-Life Research**
  Models early Earth-like or alternative abiogenetic conditions, especially in contexts lacking surfaces, gravity, or traditional boundaries.

- **Astrobiology and Planetary Analogues**
  Simulates life-like behavior in non-Earth environments (e.g., ice moons, gas giants), helping frame future exploration targets.

- **Artificial Evolution Platforms**
  Provides a modular testbed for evolutionary algorithms, autonomous mutation loops, or complexity emergence without DNA.

- **Philosophy of Mind and Simulation Theory**
  Serves as a working model of limited awareness within bounded systems — a tool for thinkers exploring epistemological limits and metaphysical boundaries.

# Layered Interpretations: Consciousness, Time, and Cosmology in a Synthetic Universe

This model functions simultaneously as a **scientific experiment** and a **multi-scale philosophical metaphor** — a living system that embodies physical laws, subjective awareness, and cosmological speculation.

It can be interpreted across three interwoven frames:

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## A. The Inner Frame — Consciousness and the Ego

Each droplet within the $scCO_2$ sphere becomes a **symbolic representation of a conscious being**:

| Element | Physical Form | Metaphorical Mapping |
|---|---|---|
| RNA | Replicating molecule | The evolving self / soul |
| Water droplet | Reaction medium | The mind: fluid, generative, experience-holding |
| Hydrogel shell | Encapsulation | The ego or body: boundary of identity, interface with reality |
| $scCO_2$ | Surrounding medium | The cosmos, the unconscious, or the unknowable real |
| Heat source | Central emitter | The flow of time, divine presence, or animating force |

Just as humans are **bounded minds** evolving inside a universe they can't fully perceive, these RNA-bearing droplets are **awareness systems** suspended in a synthetic cosmos, aware only of internal change.

The **central heat source** becomes the **driver of time and transformation** — a stand-in for time's arrow, the aging process, or divine causality. RNA mutates and replicates in response, evolving without knowing why.

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## B. The Middle Frame — Gravity and Time Dilation Analogy

In this system, heat plays the role of gravity:

- The central heating element produces **radial thermal gradients**.
- These gradients induce **motion** in the surrounding supercritical $CO_2$.
- Droplets **closer to the core** experience greater heat, faster kinetics, more rapid evolution.
- Droplets **farther out** evolve more slowly, more stably — effectively experiencing "slower time."

This mimics the core insight of general relativity:

- Proximity to energy concentration (mass/heat) **alters the rate at which time is experienced**.
- The **biochemical rate of change** becomes a molecular stand-in for **the passage of time**.

Thus, this experiment doesn't just simulate time dilation metaphorically — it **reconstructs it in molecular form**. Life evolves differently depending on **where** it exists within the field — just as we age differently depending on where we exist in spacetime.

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## C. The Outer Frame — Brane Cosmology and Simulation Theory

Zooming out, the entire setup becomes a **physical model of brane cosmology**:

- Each hydrogel droplet is a **universe unto itself** — a "brane" floating in a higher-dimensional bulk (the $scCO_2$ sphere).
- These universes do not interact directly — but all are governed by the same hidden laws.
- Occasionally, material may "leak" between them (if RNA is transferred), resembling **brane collisions** or interdimensional influence.

This echoes theories where:

- Our universe is a **4D membrane** suspended in a higher-dimensional space.
- What we perceive as reality is only one droplet — one **bounded perspective** — among countless others.

And who set this system in motion?

Us.

By building this model, we — the designers — become **the grand experimenters**: outside the system, observing, intervening, and maintaining environmental control.

To the RNA, there is no proof we exist.

To us, the RNA is not “alive” in our sense — and yet it **evolves, adapts, and changes**.

This raises a question so direct and terrifying that it almost defies language:

> If we can create a microcosm that obeys time, space, entropy, evolution, and boundary — all without the awareness of the internal entities — who is to say the same hasn’t been done to us?

In this way, the model becomes a **working metaphor for simulation theory** — not in code, but in chemistry. Not in pixels, but in physics.

And if the model works? Then we know it is, at the very least, **possible** to build such a nested world — and therefore possible that we live in one.

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# Summary

This system is:

- A biochemical testbed for evolution
- A physical analogy for time and gravity
- A compartmentalized model of consciousness
- A brane-world cosmological map
- A philosophical device to interrogate simulation theory

It is not just an experiment. It is **a metaphor with measurable outputs** — a cosmic poem written in gel, heat, and code.

# Author’s Intent

I am not a formally trained scientist. I do not possess a laboratory, a research team, or institutional backing. What I do have is a deep desire to contribute something meaningful — not for recognition, wealth, or prestige, but simply because I believe that ideas, when given the chance to breathe, can open doors into understanding ourselves, our origins, and the fabric of reality itself.

This concept — a microgravity-based model simulating evolution, time dilation, and nested consciousness through biochemical systems — is offered freely. I do not seek ownership, only the opportunity to be remembered as the one who first imagined it. If this idea helps accelerate our scientific understanding of emergence, life, or cosmology — if it inspires just one person to think more deeply about existence — then that is more than I could have ever asked for.

We live in a time where it is easy to feel powerless — as if only the elite or well-connected can shape the future. But I believe that insight can come from anywhere. That the boundaries we place between disciplines, people, and institutions are not the same boundaries the universe recognizes. And sometimes, it is the outsider who sees clearly what those within the system are too entangled to notice.

This model is, at its heart, an invitation — not just to test a scientific hypothesis, but to explore a layered metaphor: of consciousness suspended in a medium it cannot perceive, of time shaped by hidden gradients, of universes within universes, blind to the hands that set them into motion.

If those who are capable — the engineers, the biologists, the physicists, the builders of tomorrow — find merit in this framework, I ask only that they consider where it came from. And perhaps, in some quiet way, include me in the journey forward.

Let this be a small seed — planted not in the soil of certainty, but in the atmosphere of possibility. If it grows, it belongs to everyone.

— Almer Ajdinovic, July 2025