Theory of the Origin, Evolution, and Nature of Life

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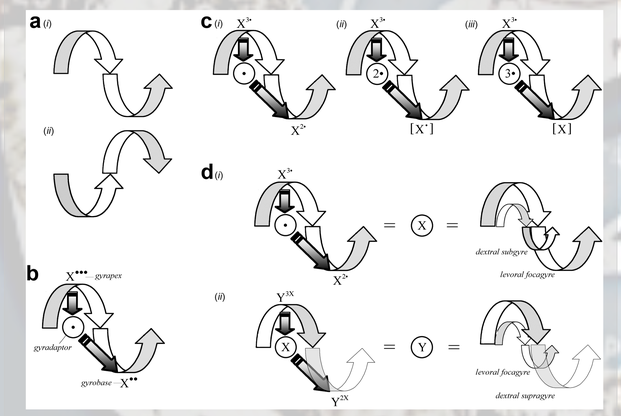
ABSTRACT | Life is an inordinately complex unsolved puzzle. Despite significant theoretical progress, experimental anomalies, paradoxes, and enigmas have revealed paradigmatic limitations. Thus, the advancement of scientific understanding requires new models that resolve fundamental problems. Here, I present a theoretical framework that economically fits evidence accumulated from examinations of life. This theory is based upon a straightforward and non-mathematical core model and proposes unique yet empirically consistent explanations for major phenomena including, but not limited to quantum gravity, phase transitions of water, why living systems are predominantly CHNOPS (carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur), homochirality of sugars and amino acids, homeoviscous adaptation, the triplet code, and DNA mutations. **The theoretical framework proves the unity of macrocosmic and microcosmic realms, validates predicted laws of nature, and solves the puzzle of the origin and evolution of cellular life in the universe.**

1 Gyromodel Facts, Features, Flow

Geometric	Organic	Oscillatory
Singularity	Self-organizing	Cyclic
Chiral	Unpredictable	Autoregulatory
Symmetrical	Coherent	Homeostatic
Vectorial	Fractal	Attractorepulsive
Exponential	Thermodynamic	Creatodestructive
Nonlinear	Dissipative	Expansocontractive



Core theoretical concepts. (**a**) Gyromodel chirality. (*i*) Transverse view of a left-handed gyre (levoragyre). (*ii*) Transverse view of a right-handed gyre (dextragyre). The first and second half-turns of the gyres are depicted as bent arrows. White, gyre interior; grey, gyre exterior. (**b**) Archetypal gyromodel. This gyromodel—supplemented with symbolic variables—is an exemplar for understanding IEM emergence, adaptation, movement, and evolution in the natural world. The bold straight arrows represent IEM directionality. The first bold arrow, from the gyrapex (X•••) to the gyradaptor (⊙), represents mIEM particle (•) attraction (absorption) to the singularity, causing the diquantal dIEM (X••) to cycle to the gyrobase. The second bold arrow, from the gyradaptor to the gyrobase, represents the mIEM particle repelled (emitted) from the singularity, ultimately causing the diquantal dIEM to cycle to the gyrapex, restoring the triquantal dIEM (next cycle not shown here). The gyromodel thus depicts an *open* thermodynamic system. (**c**) Majorgyres. Majorgyres are the three main gyromodels at the core of each gyrosystem in the theoretical framework: (*i*) primary (1°) majorgyre; (*ii*) secondary (2°) majorgyre; and (*iii*) tertiary (3°) majorgyre. Note how the gyrapex is shared by all three majorgyres. (**d**) Gyre-quantum equivalence and Matrioshkagyres. *Left-side equations*. (*i*) The gyre—modeling the cycling • on/in and off/out of X due to the attractorepulsive quantum ⊙—is the compressed into Ⓧ, a quantum. (*ii*) Ⓧ, in turn, is the gyradaptive force responsible for cycling X on/in and off/out of Y. *Right-side equations*. (*i*) ⊙ is a dextral subgyre (dextrasubgyre) in the levorafocagyre. (*ii*) The levorafocagyre is antichiral to the dextrasupragyre. Ⓧ and Ⓨ are antichiral Matrioshkagyres.

2 Caveats, Organization, and Axioms

Preceptive	Interpretability	Pedigreed
Incommensurability	Iconoclastic	Reified
Semantics	Non-mathematical	Heuristic
Neologisms	Tellurian	Unified

Gyrosystem Organization

					Gyrostates[b]		Chirality[c]		
Gyre	**Quantum**	**dIEM**	**mIEM**	**Gyradaptor**	**Gyrapices**	**Gyrobases**	**Gyre**	**1°/2°[d]**	**3°[e]**
Electrogyre	Electron	e	$\gamma^{\pm}$	Ⓨ	$e^{2\gamma}$	$e^{2\gamma}$, [e^{γ}], [e]	L	D	L
Oxygyre	Oxyon	O	e	ⓔ	O^{3e}	O^{2e}, [O^{e}], [O]	D	L	D
Carbogyre	Carbyon	C	O	Ⓞ	C^{3O}	C^{2O}, [C^{O}], [C]	L	D	L
Phosphogyre	Phosphon	P	C	Ⓒ	P^{3C}	P^{2C}, [P^{C}], [P]	D	L	D
Ribogyre	Ribon	R	P	Ⓟ	R^{3P}	R^{2P}, [R^{P}], [R]	L	D	L
Aminogyre	Aminon	A	R	Ⓡ	A^{3R}	A^{2R}, [A^{R}], [A]	D	L	D
Genogyre	Genon	D	A	Ⓐ	D^{3A}	D^{2A}, [D^{A}], [D]	L	D	L
Cellulogyre	Cellulon	Ç	D	Ⓓ	$Ç^{4D}$, $Ç^{2D}$	[$Ç^{2D}$], [$Ç^{D}$], [Ç]	$D^{\dagger}$	$L/D^{\dagger}$	$D/L^{\ddagger}$

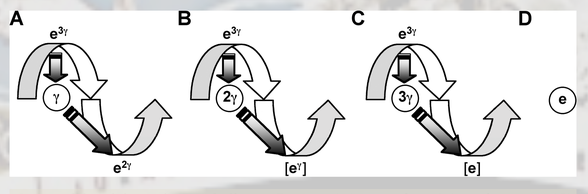
[a] This table complements the gyromodels in Figure 2.
[b] Gyrapices are the learning gyrostates; gyrobases are the memory gyrostates.
[c] Gyre and IEM exist cosmically in both chiralities but in life are almost exclusively in one chirality (see footnote 'e'). D, dextral; L, levoral.
[d] The 'γ' models the photon.
[e] 1°, primary majorgyre IEM; 2°, secondary majorgyre IEM; and 3°, tertiary majorgyre IEM.
[f] Several gyraxioms — G_{VI}, G_{VII}, G_{VIII}, G_{VIII}, and G_{XIII} — clarify why the gyre and IEM chirality are "primarily" one form in cells as opposed to exclusively one form. As the exergy of the gyrosystem diminishes, such that e >>>>>>> O >>>>>> C >>>>> P >>>> R >>> A >> D > Ç, the rate of IEM flow concomitantly diminishes. The relativistically reduced attractorepulsive effect of the genon on the cellulogyre (compared to earlier gyrosystem relationships) means that the subgyres have greater potential to impact cellulogyre form and function. Thus, while oscillating chirality (G_{VI} and G_{XII}) is retained in principle, theory fits the data in practice.

dIEM, defining IEM; mIEM, modifying IEM

Gyraxioms

Gyraxiom (G)	Description
G_I	A quantum is a gyre.
G_{II}	A gyrating particle is a wave.
G_{III}	The quantum is either one particle or many particles.
$G_{III\text{-}1}$	A particle has quantum potential.
G_{IV}	A particle cannot be reduced from its gyre without IEM loss.
$G_{IV\text{-}1}$	A gyre cannot be reduced from its gyrosystem without IEM loss.
G_V	A particle oscillates between excited and ground states but cannot simultaneously exist in more than one state in spacetime.
G_{VI}	A gyre oscillates between left and right chirality but cannot simultaneously exist as more than one chirality in spacetime.
G_{VII}	Antichiral Matrioshkagyres are more homeostatic and stable than synchiral Matrioshkagyres.
G_{VIII}	A focagyre is thermodynamically dependent upon one or more of its subsumed gyres.
$G_{VIII\text{-}1}$	A focagyre is thermodynamically required for one or more of its supervenient gyres.
G_{IX}	A focagyre contains at least one novel, emergent IEM form distinct from its subgyre.
G_X	In a secondary majorgyre, the gyrolink of the gyronexus is an IEM of the subgyre. Given G_I, the gyrolink represents the subgyre itself.
G_{XI}	In the tertiary majorgyre, the gyrolink of a gyronexus is the dIEM of the sub$_2$gyre.
$G_{XI\text{-}1}$	A tertiary majorgyre gyrolink, in coupling to other tertiary majorgyres, facilitates IEM flow between and among subsumed gyrosystems.
G_{XII}	The IEM in primary and secondary majorgyres has subgyre chirality. In other words, dextral IEM oscillates in a levoral focagyre due to force exerted by dextral subgyre. Levoral IEM oscillates within a dextral focagyre due to force exerted by levoral subgyre (see Fig. 1d).
$G_{XII\text{-}1}$	When countervailing forces of an antichiral Matrioshkagyre offset *exactly*, the focagyre IEM does not have chirality; *i.e.* the particle does not spin.
$G_{XII\text{-}2}$	The IEM in the gyrobase of the tertiary majorgyre has sub$_3$gyre chirality.
$G_{XII\text{-}3}$	Given G_V and G_{VI}, IEM higher-order organization and fractalization within a focagyre elicits chiral toggling.
G_{XIII}	Subgyres are more exergic and less stable than focagyres. Relativistically, the subgyre IEM is of a higher quality of energy that is extractable for work.

3 Electrogyre/Electron

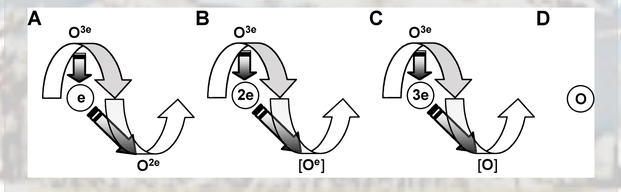


Gyromodels of leptonic metabolism. Primary (**A**), secondary (**B**), and tertiary (**C**) electrogyre. **D**. Electron; any lepton.

Origin of visible matter	Quantum gravity
Lepton structure and organization	Origin of planets
Origin of chemical elements	Orbits and orbitals
Fermi gas and liquid	Geomagnetic reversal
Electromagnetism	Antimatter

The electrogyre models, explains, positions, and predicts core physical phenomena and provides a framework for understanding the origin and evolution of planets and planetary systems.

4 Oxygyre/Oxyon

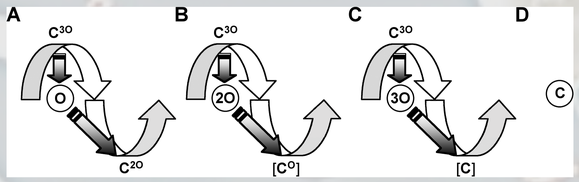


Gyromodels of oxychemical metabolism. Primary (**A**), secondary (**B**), and tertiary (**C**) oxygyre. **D**. Oxyon.

Origin of water	Origin of oceans
Phase transitions	Planetary atmosphere
Nature of water	Planetary geophysics
Oxygen species	Lunar formation
Oxide geochemistry	Tidal-lunar cycles

The oxygyre unifies present-day celestial mechanics, geophysical processes, and thermodynamics of water with the origin and evolution of planets, moons, oceans, and molecular oxygen.

5 Carbogyre/Carbyon

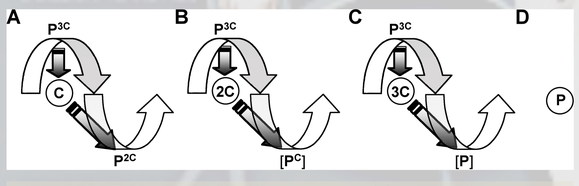


Gyromodels of organochemical metabolism. Primary (**A**), secondary (**B**), and tertiary (**C**) carbogyre. **D**. Carbyon.

Origin of organic matter	Origin of hydrocarbons
Origin of carbon dioxide	Immiscibility
Carbohydrates and homochirality	Fatty acids
Photosynthesis	Alcohols
Bio-organic cycles	Asteroids and comets

The carbogyre explains how the cell, Earth, and universe produce and perennially reproduce specific organic chemicals in exactitude and provides theoretical validation of the Gaia hypothesis.

6 Phosphogyre/Phosphon

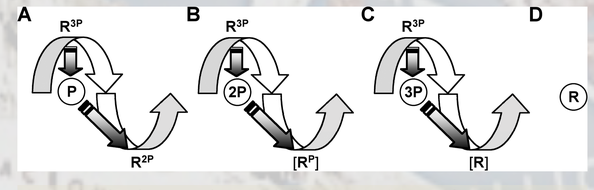


Gyromodels of phosphochemical metabolism. Primary (**A**), secondary (**B**), and tertiary (**C**) phosphogyre. **D**. Phosphon.

High-energy phosphate bond	Homeoviscous adaptation
Phosphoenol pyruvate	Phosphate homeostasis
Sugar phosphates	Intracellular signaling
Origin of phospholipids	Phosphate biogeochemistry
Phosphomembranes	Origin of polyphosphates

The phosphogyre reveals that phosphomembranes formed prior to nucleic acids, proteins, and dividing cells, consistent with ideas regarding protocell evolution and a prebiotic lipid world.

7 Ribogyre/Ribon

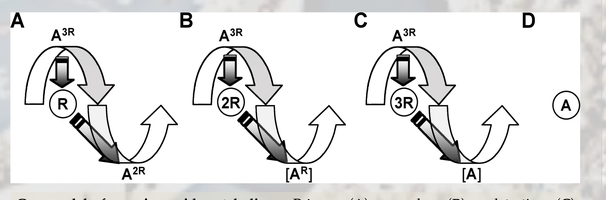


Gyromodels for nitrogenous base metabolism. Primary (**A**), secondary (**B**), and tertiary (**C**) ribogyre. **D**. Ribon.

Nucleotide phosphates	Origin of genetic code
Origin of RNA	Ribovirogenesis
Transcription and turnover	Nitrogenous compounds
RNA structure and function	Amino acid origins
Secondary messengers, cofactors	Nitrogen biogeochemistry

The ribogyre shows how life uses nucleotides for information transmission and energy storage and validates the existence of an RNA world prior to the emergence of protein, DNA, and the cell.

8 Aminogyre/Aminon

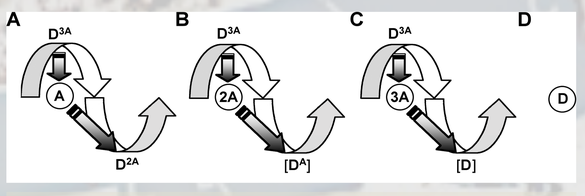


Gyromodels for amino acid metabolism. Primary (**A**), secondary (**B**), and tertiary (**C**) aminogyre. **D**. Aminon.

Origin of translation apparatus	Ribonucleoproteins
Specificity of genetic code	Post-translational modifications
Polypeptide synthesis and decay	Membrane proteins
Aminoacyl-tRNA metabolism	Non-ribosomal peptides
Protein structure and folding	CHNOPS

The aminogyre explains the specificity of the genetic code, and how proteins behave, lengthen and shorten, fold and unfold in response to physical and biometabolic changes.

9 Genogyre/Genon

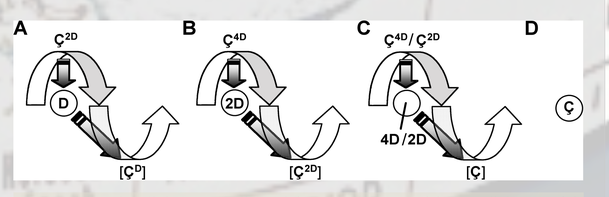


Gyromodels for deoxynucleotide metabolism. Primary (**A**), secondary (**B**), and tertiary (**C**) genogyre. **D**. Genon.

Origin of deoxynucleotides	Origin of mutations
cis-acting DNA elements	Exons and introns
Chromatin	Genome phylogeny
Chromosomes	dNTP pools
Origin of DNA viruses	Flow of genetic information

The genogyre confirms the nature and composition of the DNA world that existed in evolution of life on Earth and heuristically explains genomic stability, plasticity, and inheritance.

10 Cellulogyre/Cellulon

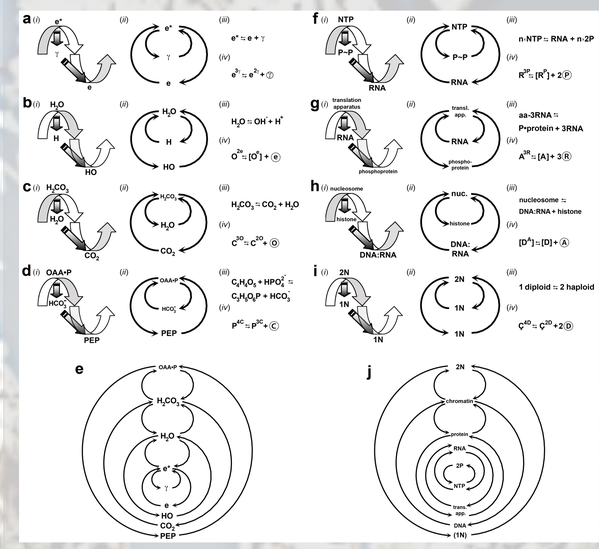


Gyromodels of cellular metabolism. (**A**) Hapcellulogyre; (**B**) Dipcellulogyre; (**C**) Acellulogyre. **D.** Cellulon.

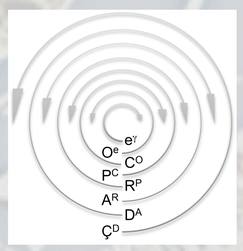
Origin of life	Origin of meiosis and sex
DNA replication	Aging and death
Cell division	C-value enigma
Cell cycle	Integument
Cell shape and size	Circadian rhythms

The cellulogyre correctly models the ontogeny of the extant, living cell and the phylogeny of all kingdoms of life, unveiling the unity, depth, and nature of life.

11 Nested Gyral Organization of Life

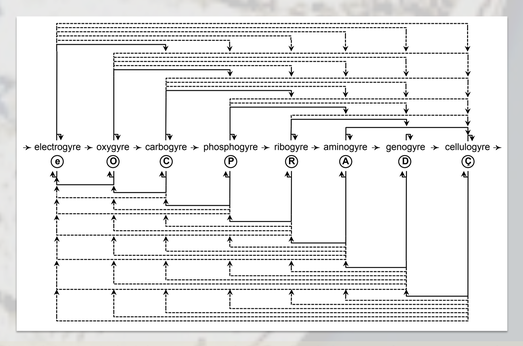


Understanding singularities. **(a-d, f-i)** Each singularity (gyre center) is represented as follows: (*i*) Gyrosystem; (*ii*) *en face* Matrioshkagyre; (*iii*) bidirectional, linear reaction or process; (*iv*) gyrequation. **(a)** Primary electrogyre. **(b)** Alternoxygyre. **(c)** Primary carbogyre; OAA is oxaloacetic acid, **(d)** Alternaphosphogyre; n = any positive integer; P~P is pyrophosphate. **(e)** *en face* Matrioshkagyre of the presented electro-, oxy-, carbo-, and phosphogyres. **(f)** Secondary ribogyre. **(g)** Tertiary aminogyre. Translation apparatus is the same as aa-3RNA. **(h)** Alternagenogyre. **(i)** Hapcellulogyre. Here, 1N and 2N represent chromosome content. **(j)** *en face* Matrioshkagyre of the ribo-, amino-, geno-, and cellulogyres.



Within-to-without theoretical framework. The electrogyre (where e^{γ} denotes all lepton potentialities) is within the oxygyre (O^{e}; all oxyon potentialities) which is within the carbogyre (C^{O}; all carbyon potentialities) which is within the phosphogyre (P^{C}; all phosphon potentialities) which is within the ribogyre (R^{P}; all ribon potentialities) which is within the aminogyre (A^{R}; all aminon potentialities) which is within the genogyre (D^{A}; all genon potentialities) which is within the cellulogyre ($Ç^{D}$; all cellulon potentialities). Matrioshkagyres achieve homeostasis by reducing the rate of IEM metabolism and flow between, among, and within gyrosystems. Time flows from within to without. Note the widening gyre.

12 Laws, Proofs, and Implications



Left-to-right theoretical framework. The arrowheads between the gyrosystems (center flow line) represent both the evolutionary process leading up to the origin and evolution of cells and how existing cells work. The arrowheads to the left and right of the center line depict the evolutionary steps prior to and following the origin of visible matter and the cell, respectively. The arrowed lines above the center line depict the feedforward; those below depict feedback. The IEM flow modeled by tertiary gyrobases is labeled as dark lines. The dotted lines represent empirically definable IEM flow.

Fourth law of thermodynamics	Law of complementarity
Law of polymers	Law of relativity
Law of vortex motion	Law of trimergence
Law of correspondence	Law of unity

Origins	Meaning of life
Arrow of time	Search for extraterrestrial life
Entropy	Causality and necessity
Adaptation	Metaphysics
Evolutionary emergence	Epistemological rupture

CONCLUSIONS | This theory proves the following: Life is a consequence of natural progression and physico-chemical ordering laws; the living cell recapitulates the origin of life; life originates at any spatiotemporal coordinate in the universe where IEM thermodynamics are accommodating; life cannot be simplified; the universe is alive; physical reality is one.

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