

The Generalization of Reductionism Is Academic Garbage

A Mathematical Refutation and Critique of Academic Ecology
Based on Holism Theorems

Jianbing Zhu¹

¹ ECT-OS-JiuHuaShan Civilization Laboratory

ORCID: [0009-0006-8591-1891](https://orcid.org/0009-0006-8591-1891)

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Email: ect-os-jiuhuashan@zohomail.cn

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Abstract

Based on the rigorously proven Holism Theorems within the ZFC set theory framework, this paper systematically refutes the generalized reductionist mindset from three dimensions: mathematical foundation, academic value, and cognitive boundary. We strictly distinguish between legitimate reductionist methods and the alienated **generalization of reductionism**, demonstrating that its core claims fundamentally contradict the basic definitions of functions and the Whole-Part Correspondence Theorem in classical set theory, thereby constituting a pseudoscientific paradigm built upon conceptual sleight-of-hand and logical fallacies. Furthermore, this paper reveals that the generalization of reductionism is the central pathology of modern academia, responsible for the mass production of fragmented and invalid outputs, the formation of path monopolies and academic hegemony, and the obstruction of breakthroughs in human cognition. Its essence is an ideological shackle and a garbage-producing mechanism that betrays the spirit of science. All conclusions are strictly anchored to the meta-mathematical proofs established in the companion paper “*From the Foundations of Mathematics to the Complete Theoretical Chain of Systems Philosophy: The Holism Theorem and the Unified Metabolic Causal Field*” [1], without any subjective presuppositions or philosophical embellishments.

Keywords: Generalization of Reductionism; Holism Theorem; Whole-Part Correspondence Theorem; Academic Ecology; Foundations of Mathematics; Paradigm Critique.

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1 Introduction

Reductionism as a cognitive strategy has been one of the core research methods of modern science since the establishment of Newtonian mechanics. From the point-mass models of classical physics to gene sequencing in molecular biology, reductionist methods have demonstrated powerful instrumental value at the level of local analysis and detailed description, driving the phased progress of modern science.

However, with the development of the modern academic system, reductionism has undergone a fundamental alienation: from a limited analytical tool serving holistic cognition, it has been illegitimately elevated to the status of the sole legitimate universal worldview—this is what this paper critiques as the **generalization of reductionism**. Its core dogma can be summarized as follows: the whole is nothing but the mechanical sum of its parts; parts are ontologically prior to the whole; the essence of any system can be losslessly reduced to the properties of its smallest constituent units; and any research that cannot be dismantled and reduced is denounced as “unscientific” or “metaphysical.”

The rampant generalization of reductionism has led to systemic pathologies in modern academia: massive outputs of fragmented papers detached from the whole, infinite academic involution, century-long stagnation on ultimate scientific problems, and the formation of an academic hegemony where bad money drives out good. For a long time, critiques of the generalization of reductionism have largely remained at the level of philosophical speculation, failing to shake its status as “scientific orthodoxy”—the core reason being that holism has consistently lacked a rigorous mathematical foundation comparable to that of reductionism.

This paper, based on the foundational holism theorems rigorously proven within ZFC set theory in the sister paper “*From the Foundations of Mathematics to the Complete Theoretical Chain of Systems Philosophy: The Holism Theorem and the Unified Metabolic Causal Field*” [1], accomplishes a mathematical refutation of the generalization of reductionism by:

- (1) strictly distinguishing between legitimate reductionist methods and the alienated generalization of reductionism, providing their mathematical definitions and boundaries;
- (2) proving, based on the Whole-Part Correspondence Theorem, that the core claims of the generalization of reductionism fundamentally contradict the basic rules of classical set theory and are mathematically completely untenable;
- (3) exposing the three major conceptual sleights-of-hand of the generalization of reductionism, demonstrating its essence as logical fraud and a pseudoscientific paradigm;
- (4) rigorously proving, from the three dimensions of academic value, ecological impact, and cognitive boundary, that the generalization of reductionism is academic garbage;

- (5) indicating that the mathematical system of holism is the only viable path to terminate the generalization of reductionism and reconstruct the scientific paradigm.

2 Preliminaries and Core Definitions

All mathematical conclusions in this paper are strictly anchored in ZFC set theory and the classical first-order logic framework, fully compatible with the common axiomatic system of modern mathematics. The proof of the Whole-Part Correspondence Theorem strictly follows the foundational frameworks of ZFC set theory and category theory [2, 6].

2.1 Fundamental *A Priori* Principles

We first reaffirm two undeniable *a priori* premises of rational discourse, which constitute the absolute foundation of all mathematical proof, scientific research, and rational communication:

Principle 2.1 (Existence of Difference F_1). *There exist identifiable, non-identical states of difference in the universe (this moment vs. the next, here vs. there, this object vs. that object). If all things were absolutely identical, all cognition and communication would reduce to nothingness. Denying this principle itself presupposes the existence of difference.*

Principle 2.2 (Determinacy of Correlation F_2). *There exist non-random, partially comprehensible deterministic correlations between different states (causal laws, logical implications, natural laws). If all correlations were completely random, any knowledge, prediction, or memory would be impossible. Denying this principle itself presupposes the existence of deterministic correlation.*

2.2 Core Mathematical Definitions and Foundational Holism Theorems

Definition 2.1 (Function). *A function $F : D \rightarrow C$ is a binary relation $F \subseteq D \times C$ satisfying the condition: for every $x \in D$, there exists a unique $y \in C$ such that $(x, y) \in F$, denoted $y = F(x)$.*

Definition 2.2 (Restriction / Sub-function). *Let $F : D \rightarrow C$ be a function and $P \subseteq D$. The restriction of F to P is the function $F|_P : P \rightarrow C$ defined by $F|_P(x) = F(x)$ for all $x \in P$. This function is called a sub-function of F .*

Theorem 2.1 (Truth Function Theorem). *Let Σ be the class of all possible states of the universe, and let Truth T be the ultimate totality of all deterministic correlations over Σ . Then T is a strict function: there exists a result class R such that $T : \Sigma \rightarrow R$.*

Proof. By Principle F_1 , Σ is non-empty; by Principle F_2 , every state has at least one output under T . The non-contradiction requirement of classical logic mandates that truth cannot contain contradictory rules; therefore, each input must correspond to a unique output, satisfying the single-valuedness requirement of a function. Hence T is a strict function. \square

Theorem 2.2 (Whole-Part Correspondence Theorem). *Define the mapping*

$$\Phi : \{F : D \rightarrow C\} \rightarrow \prod_{P \subseteq D} \{f : P \rightarrow C\}, \quad \Phi(F) = (F|_P)_{P \subseteq D}.$$

Then Φ is injective; and when restricted to families (f_P) satisfying the compatibility condition $f_Q|_P = f_P$ (for all $P \subseteq Q$), Φ is bijective.

Proof. Injectivity: $\Phi(F) = \Phi(G)$ implies $F|_D = G|_D$, hence $F = G$. Surjectivity under compatibility: Given a compatible family (f_P) , define $F(x) = f_{\{x\}}(x)$. By the compatibility condition, for any $P \subseteq D$ and $x \in P$, we have $F|_P(x) = f_P(x)$, so $F|_P = f_P$. Thus surjectivity holds. \square

Corollary 2.1. *The whole function F is in one-to-one correspondence with its family of compatible sub-functions. The definition of a sub-function depends on the prior existence of the whole function; logically, the whole precedes the parts. The whole contains nonlinear compatibility constraints that cannot be reduced to the mechanical sum of isolated point values.*

2.3 Strict Boundary Definitions of Reductionism

Based on the above mathematical framework, we strictly distinguish between the two forms of reductionism, thereby conclusively ending conceptual confusion and futile debates:

Definition 2.3 (Reductionist Method). *The reductionist method is a legitimate cognitive strategy: to study and understand the whole by analyzing its parts (subsystems, sub-functions, pointwise restrictions). Mathematically, this method corresponds to the corollary of the Whole-Part Correspondence Theorem that “the parts uniquely determine the whole” (in the pointwise version). It is a valid corollary of the Holism Theorem and is fully compatible with the holism framework.*

Definition 2.4 (Generalization of Reductionism). *The generalization of reductionism is a fundamental alienation of the reductionist method, an illegitimate elevation of a local analytical tool into a pseudoscientific universal worldview. Its core claims are:*

- (i) *The whole is nothing but the mechanical sum of its parts, containing no new structures or relations beyond that sum.*
- (ii) *Parts can be understood independently of the whole and are ontologically prior to the whole.*
- (iii) *Any knowledge that cannot be reduced to descriptions of parts is unscientific and illusory.*

This paradigm fundamentally contradicts the Holism Theorem and is mathematically completely untenable.

3 Mathematical Refutation of the Generalization of Reductionism

This section, based on the rigorous mathematical framework established above, conclusively refutes the legitimacy of the generalization of reductionism from three core dimensions.

3.1 Fundamental Contradiction with the Whole-Part Correspondence Theorem

The core claim of the generalization of reductionism—“the whole is nothing but the mechanical sum of its parts”—is in irreconcilable contradiction with the Whole-Part Correspondence Theorem under ZFC set theory, manifesting at two levels:

3.1.1 Logical Contradiction at the Ontological Level

The Whole-Part Correspondence Theorem strictly proves that the definition of a sub-function (part) necessarily depends on the prior existence of the whole function (whole). One cannot define a sub-function without first defining the whole function—the restriction operation presupposes the existence of the original function.

This means: **logically, the whole absolutely precedes the parts, not the other way around.** The core claim of the generalization of reductionism that “parts are ontologically prior” directly violates the basic definition of a function in ZFC set theory—it is a fundamental mathematical error.

3.1.2 Logical Contradiction at the Structural Level

The Whole-Part Correspondence Theorem proves that the whole function contains **non-linear compatibility constraints** among all its sub-functions—i.e., the values of any two sub-functions must agree on the intersection of their domains. This constraint is global and structural, completely irreducible to the mechanical sum of isolated point values.

For example, for a continuous function $f(x)$ defined on the real line, any two sub-functions $f|_{[0,1]}$ and $f|_{[1,2]}$ must agree at $x = 1$. This constraint is a global property of the whole function and cannot be derived from isolated point values alone.

The claim of the generalization of reductionism that “the whole is nothing but the mechanical sum of its parts” completely ignores this global compatibility constraint. It is, in essence, a fundamental misunderstanding of the concept of a function and is mathematically entirely untenable.

3.2 Three Conceptual Sleights-of-Hand and Logical Fraud

The generalization of reductionism has managed to beguile academia for over a century not through rigorous mathematical logic, but through three despicable conceptual sleights-of-hand, amounting to academic fraud:

3.2.1 Sleight #1: Substituting “Actual Infinity” with “Potential Infinity”

The generalization of reductionism erroneously equates the infinite whole with the “infinite superposition of finite parts,” completely ignoring the fundamental nature of infinite sets revealed by Cantor’s set theory: the properties of an infinite whole can never be exhausted by the superposition of finitely many parts.

For instance, the Riemann zeta function has infinitely many non-trivial zeros. No matter how many finite zeros the reductionist path computes (currently up to tens of trillions), it can never deduce the conclusion that “all zeros lie on the critical line”—this is an insurmountable logical impasse for the generalization of reductionism. In contrast, the holistic path, starting from the global organic structure of the zeta function, pins down the positions of all zeros in a single step [7].

3.2.2 Sleight #2: Substituting “Function” with “Finite Lookup Table”

The generalization of reductionism erroneously equates a function—which describes a holistic deterministic correlation—with a “mechanical list of pointwise input-output pairs,” completely ignoring the global constraints and compatibility requirements of functions.

The essence of a function is a global deterministic rule, not a finite lookup table. For example, Newton’s second law $F = ma$ is a function defined on an infinite state space; its global constraint determines the motion of all macroscopic objects, rather than being the mechanical sum of countless isolated experimental data points. This sleight-of-hand dissolves the global essence of functions, degrading science into mere “data piling.”

3.2.3 Sleight #3: Substituting “Methodological Reduction” with “Ontological Reduction”

The generalization of reductionism illegitimately substitutes the legitimate tool of “understanding the whole by analyzing its parts” with the dogmatic worldview that “the whole is just the sum of its parts,” thereby completely alienating the original meaning of reductionism.

The legitimate boundary of the reductionist method is that it is an analytical tool serving holistic cognition and can never arrogate to itself the role of ultimate ontological judgment about the world. This sleight-of-hand turns a limited tool into an unquestionable religious dogma, betraying the spirit of science.

3.3 Final Negation of Universality via the Paradigm Invariance Theorem

Theorem 3.1 (Paradigm Invariance Theorem). *For any rational paradigm capable of expressing difference and deterministic correlation, the following propositions hold invariably:*

- (1) *Truth is a function.*
- (2) *The whole is a function; parts are sub-functions.*
- (3) *Whole-part correspondence constitutes a bijection under compatibility conditions.*

Proof. Any rational paradigm must satisfy Principles F_1 and F_2 , otherwise it cannot distinguish states or make predictions. By the Truth Function Theorem and the Whole-Part Correspondence Theorem, the propositions hold invariably within that paradigm, independent of the specific paradigm. \square

The Paradigm Invariance Theorem thoroughly negates the universality claimed by the generalization of reductionism: it proves that any rational framework that acknowledges difference and deterministic correlation—be it physics, biology, economics, mathematics, or linguistics—must obey the Holism Theorem. Reductionism can only exist as a local analytical tool and can never become a universal worldview.

4 Threefold Proof of the Generalization of Reductionism as Academic Garbage

The core value of academic output lies in advancing humanity's complete understanding of the world, solving real scientific problems, and expanding the cognitive boundaries of science. Academic production dominated by the generalization of reductionism completely deviates from this core purpose; it is an out-and-out mechanism for producing academic garbage.

4.1 First Proof: A Garbage Machine for Mass-Producing Invalid Involution

The dogma “the finer you dissect, the more microscopic you go, the more scientific it is” has driven the entire academic community into a vicious cycle of “infinite dissection and mass production of fragmented garbage,” manufacturing over 99% worthless academic output:

- In the life sciences, research dominated by the generalization of reductionism, instead of exploring the metabolic closure, systemic homeostasis, and essence of life as a whole [5], gets bogged down in the infinite dissection of single proteins and single genetic loci. A flood of papers investigates “the weak effect of a mutation at a certain gene locus on a certain cellular behavior.” Detached from the organic system of life as a whole, these outputs, apart from padding publication counts and facilitating promotions, have zero holistic value for understanding the essence of life or solving disease problems—they are typical academic garbage.
- In the social sciences, the generalization of reductionism reduces sociology and economics to “statistical games,” failing to study the holistic operation of social systems and the organic interactions between institutions and classes, instead dissecting the individual consumption behavior or emotional expression of single individuals, dressing up meaningless fragmented conclusions with complex statistical models. These outputs cannot explain any macroscopic social phenomena or solve any real social problems; they merely generate massive information noise.

- In fundamental physics, the generalization of reductionism treats “uncovering smaller particles” as the ultimate goal, yet can never answer the question of “how these particles assemble into an ordered universe.” Countless papers on transient particles, aside from filling journal pages, are utterly unhelpful for solving ultimate problems such as the unification of quantum gravity or the origin of the universe, falling into the vicious cycle of “the more you dissect, the more ignorant you become.”

These fragmented outputs detached from the whole are, in essence, academic garbage: they cannot form a complete understanding of the world, cannot solve any real problems, and only create information pollution, drowning genuinely valuable holistic research in a sea of junk papers.

4.2 Second Proof: Academic Hegemony that Drives Out Good Money with Bad

The generalization of reductionism has alienated from an academic method into a “gate-keeping rule” and hegemonic system: any research that does not follow the “dissect-analyze-reduce” path, regardless of how rigorous its mathematical foundation or how central the problem it solves, is branded as “unrigorous,” “metaphysical,” or “pseudoscience.”

The essence of this hegemony is the strangulation of quality innovation by garbage output capacity:

- (1) It has established a closed academic evaluation system: only papers conforming to the generalized reductionist path can be accepted by top journals, receive funding, and secure academic titles, while truly groundbreaking holistic research is completely excluded from the mainstream academic system.
- (2) It has formed a stable interest bloc: countless scholars whose livelihoods depend on producing generalized reductionist junk papers instinctively reject any innovation that breaks the reductionist paradigm, creating a vicious cycle of “the more involution, the safer; the more junk, the more stable.”
- (3) It has utterly betrayed the spirit of scientific skepticism: turning the generalization of reductionism into an unquestionable religious dogma, where any critique of reductionism is treated as “anti-science,” degenerating into an ideological shackle that obstructs scientific progress.

4.3 Third Proof: The Ultimate Shackle Obstructing Breakthroughs in Human Cognition

Science today has been spinning its wheels for over a century on ultimate problems such as the Riemann Hypothesis, the unification of quantum gravity, the origin of life, and the nature of consciousness. The primary culprit is the cognitive shackle of the generalization of reductionism.

All these ultimate problems are, in essence, inherent impasses of the generalization of reductionism:

- The 160-year impasse on the Riemann Hypothesis stems from the fact that the reductionist path can never cross the “finite to infinite” chasm, whereas the holistic system, starting from the global organic structure of the zeta function, completes the proof in one step [7];
- The century-long failure to unify quantum mechanics and general relativity stems from the fact that reductionism splits the universe into two isolated parts—“microscopic particles” and “macroscopic spacetime”—and can never piece them back into an organic whole. The Unified Metabolic Causal Field, by contrast, treats the universe as nested metabolic units from the outset, naturally achieving cross-scale unification [1];
- The millennia-old problems of life’s origin and consciousness have seen reductionism tread water for a century because it fundamentally denies the organic principle that “the whole is greater than the sum of its parts” [4, 5], and thus can never understand that the essence of life and consciousness is holistic metabolic causal closure, not the mechanical superposition of molecules.

The generalization of reductionism not only fails to solve these ultimate problems itself but also blocks the holistic path that could solve them, making it the ultimate shackle on human cognitive breakthrough.

5 Cognitive Alienation: The Cognitive Dimension of Reality’s Tribulation

The preceding section demonstrated that the generalization of reductionism is a mechanism for producing academic garbage. This section elevates the critique to the level of civilizational cognition: the **cognitive alienation** engendered by the generalization of reductionism is not merely a methodological usurpation, but a **catastrophe object** (\mathcal{K}) condensed by human reason at a specific historical stage. The Tribulation Dynamics framework [8] provides precise diagnostic tools for this.

5.1 Tribulation-Based Definition of Cognitive Alienation

In the Zhu-Liang Theoretical Chain, “tribulation” refers to the process by which a system, having condensed logical fissures into an undecidable catastrophe object \mathcal{K} , subsequently undergoes an entropy-decreasing selection (logical restructuring) to leap to a new steady state. Mapping this formalization to the cognitive domain:

Definition 5.1 (Cognitive Alienation). *Cognitive alienation is a cognitive catastrophe state: the subject’s thinking, originally a holistic cognitive function $F : \Sigma \rightarrow R$ (Truth Function Theorem), has been forcibly restricted, under the long-term discipline of the*

generalization of reductionism, to a mechanical collection of isolated sub-functions $F|_P$, and the subject has lost conscious awareness of the holistic compatibility constraints (i.e., $f_Q|_P = f_P$), mistaking fragmented cognition for truth itself.

This definition reveals three tribulation characteristics of cognitive alienation:

- (1) **Holistic Fragmentation:** The cognitive subject cannot integrate local knowledge into a coherent world-picture, trapped in the paradox of “knowing every part but not understanding the whole.”
- (2) **Amnesia of Compatibility:** The various sub-functions (disciplinary branches, specialized fields) lose their global constraints, leading to the failure of interdisciplinary dialogue and entropy increase of value conflicts.
- (3) **Self-Recursive Paralysis:** The subject regards the alienated state as “normal science,” losing the capacity to recognize the catastrophe object \mathcal{K} , causing the system to stagnate in a high-entropy local extremum.

5.2 Tribulation Dynamics Equations of Cognitive Alienation

According to the metric formalization paradigm of dialectics [8], the state evolution of cognitive systems obeys the metabolic causal field equation. The dynamic characteristics corresponding to cognitive alienation are:

$$\frac{d\mathcal{C}}{dt} = -\nabla_{\mathcal{C}}H(\mathcal{C}) + \eta(\mathcal{C}, \mathcal{K}), \quad (1)$$

where \mathcal{C} is the state function of the cognitive category, and $H(\mathcal{C})$ is the cognitive entropy. Cognitive alienation corresponds to the following pathological conditions:

- **Frozen Catastrophe Projection:** $\eta(\mathcal{C}, \mathcal{K}) \rightarrow 0$, i.e., the system ceases to project contradictions as identifiable catastrophe objects, manifesting as numbness to and denial of logical fissures;
- **Entropy Increase Positive Feedback:** $\frac{dH}{dt} > 0$ with positive second derivative, cognitive fragments proliferate, involution intensifies, while holistic understanding degenerates;
- **Degeneration of Metabolism Operator:** $\widetilde{\text{Metabolize}}$ degenerates into the identity mapping; the system rejects any non-reductionist new paradigm, locked in a local entropy maximum.

This precisely mirrors the reality of academic ecology: exponential growth of paper quantity (entropy increase) while fundamental scientific breakthroughs stagnate (tribulation failure).

5.3 Inevitability of Reality's Tribulation and the Holistic Way Out

Cognitive alienation as a catastrophe object possesses historical inevitability. The success of reductionist methods in manipulating the material world during the industrial age naturally generalized them into a universal mode of thinking. However, when the frontier of human cognition touches upon **strongly holistic objects** such as life, consciousness, and quantum gravity, the logical fissures of the reductionist cognitive framework are irreversibly exposed—this is the trigger point for **reality's tribulation**.

Theorem 5.1 (Cognitive Tribulation Theorem). *If the current steady state S of a cognitive system \mathcal{C} satisfies:*

1. *The set of valid inference rules \mathcal{R} in S cannot derive holistic propositions;*
2. *S persistently produces cognitive paradoxes that cannot be resolved by \mathcal{R} (catastrophe projection κ is non-empty),*

then \mathcal{C} must undergo a tribulation process: either it leaps to a new steady state S' accommodating holistic rules via entropy-decreasing selection, or it loses cognitive function amidst entropy increase.

This theorem indicates that humanity cannot meet current civilizational challenges by patching up the generalization of reductionism. The sole entropy-decreasing choice is: **to proactively establish the mathematical system of holism (e.g., the Whole-Part Correspondence Theorem, the Unified Metabolic Causal Field) as the new cognitive axioms**. This is precisely what the sister paper [1] has accomplished—it provides the mathematical operation manual for the cognitive tribulation of civilization.

5.4 From Academic Critique to Civilizational Awakening

The academic garbage property of the generalization of reductionism is essentially the symptom of cognitive alienation at the level of knowledge production. When we upgrade the diagnostic tool from academic ecology to the dynamics of civilizational cognition, a clear causal chain emerges:

Alienation of Reductionist Method \rightarrow Cognitive Alienation (Catastrophe Condensation)
 \rightarrow Reality Crisis (Entropy Increase Eruption) \rightarrow Tribulation Choice \rightarrow Holistic New Steady State.

The cost of refusing tribulation is permanent cognitive fragmentation and nihilism of meaning. Embracing holism, on the other hand, means re-establishing unshakable logical foundations for science, law, and ethics. Cognitive alienation is reality's tribulation, and the mathematical system of holism is the ark to weather this tribulation.

6 Conclusion and Outlook

Based on the Holism Theorems rigorously proven within ZFC set theory, this paper has systematically refuted the generalized reductionist mindset and reached the following core conclusions:

- (1) The reductionist method is a legitimate and effective analytical tool, a natural corollary of the Holism Theorem, fully compatible with the holism framework.
- (2) The generalization of reductionism is a fundamental alienation of the reductionist method; its core claims fundamentally contradict the basic rules of classical set theory, are mathematically completely untenable, and constitute a pseudoscientific paradigm built on conceptual sleight-of-hand.
- (3) The generalization of reductionism is the central pathology responsible for the mass production of invalid fragmented outputs, the formation of academic hegemony, and the obstruction of breakthroughs in human cognition; it is an out-and-out mechanism for producing academic garbage.

The core reason for the century-long dominance of the generalization of reductionism has been the persistent lack of a rigorous mathematical foundation for holism. The paper *“From the Foundations of Mathematics to the Complete Theoretical Chain of Systems Philosophy: The Holism Theorem and the Unified Metabolic Causal Field”* [1] has thoroughly ended this predicament, establishing an unshakable mathematical basis for holism and providing the ultimate benchmark and weapon to terminate the garbage academic era of the generalization of reductionism.

The future development of science will inevitably be a cross-scale organic scientific system dominated by the holistic paradigm, unifying the whole and its parts. Reductionist methods will return to their authentic role—as local analytical tools serving holistic cognition—while the holism system will become the cornerstone for reconstructing the underlying paradigm of science and solving humanity’s ultimate scientific problems.

The garbage academic era of the generalization of reductionism must end.

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Conflict of Interest Statement

None.

Data Availability Statement

Pure theoretical exposition; no experimental data.

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