

Aristotle's Telos and the NPN Correction

From Synchronic Pull to Diachronic Push

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Abstract

Aristotle's philosophy of nature represents the most sophisticated ancient attempt to resolve the Eleatic crisis of change and determinacy. His solution—hylomorphism grounded in immanent teleology (*telos*)—provided a coherent, empirically informed system that dominated Western thought for two millennia. This paper argues that the ultimate failure of Aristotle's system, exposed by Hume's critique and incompatible with evolutionary theory, stems from a fundamental **synchronic flattening**: Aristotle's *telos* functions as a **pre-determined, intrinsic pull** from a future endpoint, reducing diachronic process to the actualization of timeless forms and effectively ignoring the entropic cost of maintaining order. In contrast, the Neo-Pre-Platonic Naturalist (NPN) framework corrects this by positing *Hormē* (constitutive striving) as an **intrinsic, open-ended push** from the present, and by asserting the ontological primacy of Becoming (FP2). This shift—from pull to push, from synchronic blueprint to diachronic navigation—explains why Aristotle's system could not accommodate genuine contingency, novelty, or evolution, while NPN provides a robust metaphysical basis for a dynamic, navigational, and post-Darwinian worldview.

Keywords: Aristotle, teleology, final cause, *telos*, hylomorphism, synchronic, diachronic, Becoming, *Hormē*, Neo-Pre-Platonic Naturalism, NPN, Eleatic crisis, Hume, evolution, process philosophy, entropy, thermodynamics.

Introduction: Aristotle as the Great Synthesizer

The Eleatic crisis, engineered by Parmenides and Zeno, presented philosophy with an apparent dead end: either accept a frozen, undifferentiated “One” where change and plurality are illusions, or embrace a world of becoming at the cost of logical coherence.¹ The pre-Socratic responses—from the pluralisms of Empedocles and Anaxagoras to the atomism of Democritus—were salvage operations that never fully overcame the logical challenge. It fell to Aristotle (384–322 BCE) to construct the definitive ancient solution. By synthesizing Platonic formalism with empirical observation, he developed **hylomorphism**—the doctrine that every concrete substance is a compound of form (*eidos*) and matter (*hylē*)—and grounded it in a comprehensive **teleology** where every natural process is directed toward an end (*telos*).

For two millennia, Aristotle's system provided a stable, intelligible cosmos. It explained why acorns become oaks, why stones fall, and why humans seek virtue, all within a single logical framework. Yet this system ultimately collapsed under the dual pressures of **Humean empiricism** and **Darwinian evolution**. Why? This paper argues that Aristotle's failure was not incidental but **structural**, rooted in a **synchronic conception of teleology** that flattens time and cannot accommodate genuine diachronic process. Aristotle's *telos* is a **pull from a pre-set future**, a final cause already inscribed in the form, which reduces becoming to the mere unfolding of a timeless blueprint. This synchronic flattening made his system vulnerable to empirical critique and incompatible with open-ended evolution.

Furthermore, this structural flaw reveals Aristotle's attempt to “domesticate” the indeterminate ground. By relegating the *Apeiron* to the passive role of **Prime Matter**, Aristotle sought to repress the fundamental uncertainty of reality. The Neo-Pre-Platonic Naturalist (NPN) framework, developed in response to the recurrent crises of Western thought, offers the necessary correction. By asserting the **ontological primacy of Becoming (FP2)** and identifying **Hormē (constitutive striving) as the fundamental push of agency (FP6)**², NPN replaces Aristotle's teleological pull with a navigational, diachronic drive. Where Aristotle saw purpose as a predetermined attractor, NPN sees purpose as the **emergent property of a system striving to maintain alignment** within a dynamic and entropically hostile reality. This paper will: (1) reconstruct Aristotle's teleological architecture as a response to the Eleatic crisis; (2) diagnose its synchronic flaw and its vulnerability to Hume and evolution; (3) present NPN's diachronic, *Hormē*-based alternative;

¹See Eli Adam Deutscher, *The Rise of the Logicians: From Xenophanes to Socrates—and How They Almost Killed Philosophy*, 2026, <https://doi.org/10.5281/zenodo.18263959> for the full analysis of the Eleatic detonation. For the standard academic treatment of the Eleatic challenge to plurality and motion, see G. S. Kirk et al., *The Presocratic Philosophers: A Critical History with a Selection of Texts*, 2nd ed. (Cambridge University Press, 1983), 248–252; cf. Patricia Curd, *The Legacy of Parmenides: Eleatic Monism and Later Presocratic Thought* (Parmenides Publishing, 2004).

²See Eli Adam Deutscher, *Neo-Pre-Platonic Naturalism: A First-Principles Framework for Reality, Mind, and Knowledge*, Pre-Release First Edition (Neo-Pre-Platonic Press, 2025). Appendix B for the complete list of NPN First Principles and their justifications.

and (4) demonstrate why this shift from pull to push is essential for a philosophy adequate to a post-Darwinian, post-Newtonian world.

Aristotle's Teleological Architecture

To understand why Aristotle's system ultimately failed, we must first reconstruct its original strength. His response to the Eleatic challenge was not a retreat but a profound reinvention of metaphysics—one that provided a stable, intelligible world for two millennia.

Hylomorphism as a Response to the Eleatics

Aristotle inherited the Eleatic challenge: how to account for change without violating the logical law of identity. Parmenides had argued that to speak of change is to speak of something becoming what it is not—a logical impossibility.³ Aristotle's solution, developed across the *Physics* and *Metaphysics*, was to introduce a distinction between **potentiality** (*dynamis*) and **actuality** (*energeia*). A thing can change because it possesses the potential to be otherwise, while remaining identifiably itself through its enduring form.⁴

This framework is formalized in **hylomorphism**: every substance (*ousia*) is a compound of **matter** (*hylē*)—the substrate that persists through change—and **form** (*eidos*)—the organizing principle that makes the substance what it is.⁵ The acorn is not the oak tree, but it possesses the potential to become one because its matter is organized by a form that directs its development toward that end.

To fully explain natural phenomena, Aristotle famously posits **four causes**: material, formal, efficient, and final.⁶ While the first three have analogues in modern science, the **final cause** (*telos*) is uniquely Aristotelian and central to his system. The *telos* is “that for the sake of which” a process occurs—the end, purpose, or completion that explains why the process takes the form it does.

Telos as Intrinsic Pull and the Thermodynamic Oversight

In Aristotle's natural philosophy, *telos* is not an external goal imposed by a designer, but an **intrinsic principle** embedded within the form of the substance. The acorn's *telos* is the mature

³Parmenides, Frag. B8; in G. S. Kirk et al., *The Presocratic Philosophers* (Cambridge University Press, 1983), 248–52.

⁴Aristotle, *Physics* III.1–3, 201a10–202b29; *Metaphysics* IX.1–9, 1046a–1051a. For a seminal modern analysis of this distinction, see Jonathan Lear, *Aristotle: The Desire to Understand* (Cambridge University Press, 1988), 15–42; cf. W. D. Ross, *Aristotle* (Methuen & Co., 1923), 176–178.

⁵*Metaphysics* VII.3, 1029a1–30; VII.17, 1041a6–b33. On the unity of matter and form, see Mary Louise Gill, *Aristotle on Substance: The Paradox of Unity* (Princeton University Press, 1989).

⁶*Physics* II.3, 194b16–195b30; *Metaphysics* V.2, 1013a24–b3.

oak tree; the heart's *telos* is to pump blood; the human's *telos* is *eudaimonia* (flourishing) achieved through rational activity.⁷ This teleology provides a powerful explanatory framework: it tells us not just *how* things change (efficient cause) but *why* they change in the specific, orderly ways they do.

Crucially, this teleology operates as a **synchronic pull**. The end is logically and ontologically prior to the process. The form contains, in a sense, the entire developmental trajectory. As Aristotle states, "The actuality is the end, and it is for the sake of this that the potentiality is acquired."⁸ Time is thereby **flattened**: the diachronic unfolding from potentiality to actuality is merely the manifestation of a timeless formal order. The future oak tree is already present in the acorn as its final cause, pulling its development forward.

This synchronic structure reveals a critical oversight regarding **entropy**. In Aristotle's physics, order is natural; objects "want" to reach their perfect state. In the NPN framework, which accepts **Theorem T7 (The Entropic Asymmetry)**, order is statistically unlikely and expensive to maintain.⁹ Aristotle's *telos* ignores the thermodynamic cost of becoming. It treats the trajectory toward the oak tree as a metaphysical guarantee rather than a high-energy navigational achievement against the gradient of decay.

This leads to several structural consequences:

- **Determinism of Kind:** The range of possible outcomes for a substance is strictly limited by its form. An acorn cannot become a pine tree; a human cannot flourish as a solitary brute.
- **No Genuine Novelty:** Apparent novelty is merely the actualization of a pre-existing potential. Evolution in the Darwinian sense—the emergence of genuinely new forms and functions—has no place.¹⁰

⁷*On the Soul* II.1, 412a–b; *Nicomachean Ethics* I.7, 1097b22–1098a20. Contrast with Plato's external teleology in the *Timaeus*, where order is imposed by a Demiurge; see T. K. Johansen, *Plato's Natural Philosophy: A Study of the Timaeus-Critias* (Cambridge University Press, 2004).

⁸*Metaphysics* IX.8, 1050a7–9.

⁹Deutscher, *Neo-Pre-Platonic Naturalism*, 196. Monte Ransome Johnson, *Aristotle on Teleology* (Oxford University Press, 2005) provides the most comprehensive contemporary defense of Aristotelian teleology, arguing that final causes are immanent organizational principles rather than external designers. However, even Johnson's sophisticated reading cannot account for the energetic cost of organization. His analysis of biological development (pp. 187–212) treats the trajectory toward form as metaphysically guaranteed, never addressing why order should be the default state rather than decay. In contrast, Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos: Man's New Dialogue with Nature* (Bantam Books, 1984) and Terrence W. Deacon, *Incomplete Nature: How Mind Emerged from Matter* (W. W. Norton & Company, 2011) demonstrate that biological order is a far-from-equilibrium phenomenon requiring continuous energy expenditure—a reality invisible to Aristotle's synchronic framework, which treats actualization as the natural resting state rather than an ongoing thermodynamic achievement against the entropic gradient.

¹⁰For a critique of Aristotle's inability to handle speciation, see D. M. Balme, "Development of Biology in Aristotle and Theophrastus: Theory of Spontaneous Generation," in *Aristotle and the Later Tradition*, ed. I. Düring (Almqvist & Wiksell, 1962); cf. James G. Lennox, *Aristotle's Philosophy of Biology* (Cambridge University Press, 2001).

- **Closure of Explanation:** Once the *telos* is identified, explanation is complete. There is no need to appeal to open-ended processes, contingency, or historical path-dependence.

The Success and Stability of the Aristotelian World

Despite these limitations, Aristotle's system was a monumental achievement. It provided a **unified, intelligible cosmos** that answered the Eleatic challenge while respecting empirical observation. Change was real, but it was lawful, directed, and meaningful. The universe was a great **scala naturae** (great chain of being), with each entity striving toward its own perfection, all within a coherent hierarchical order.¹¹

This vision proved incredibly stable. It dominated medieval Scholasticism, informed early modern science (including Newton's search for final causes in physics), and underpinned traditional virtue ethics.¹² For two millennia, it served as the **paradigmatic reconstructive response** to the crisis of ground: it built a new, determinate foundation (teleological forms) that seemed to banish the specter of the indeterminate *Apeiron*. Yet, as we shall see, the repressed ground would return—first in the guise of **prime matter**, and later through the empiricist and evolutionary critiques that shattered the synchronic illusion.

The Cracks in the Synchronic Edifice

Despite its monumental coherence, Aristotle's system contained latent vulnerabilities. These were not incidental flaws, but structural tensions that would eventually widen under pressure from empiricism and evolutionary theory.

Internal Tension: The Specter of Prime Matter

Even within Aristotle's system, a telltale crack appears: the concept of **prime matter** (*prōtē hylē*). Prime matter is the ultimate substrate underlying all change—pure potentiality with no

¹¹*On the Heavens* I.1–2, 268a–270b; *History of Animals* VIII.1, 588a–589a.

¹²For two millennia, this system served as the paradigmatic reconstructive response. Arthur O. Lovejoy, *The Great Chain of Being: A Study of the History of an Idea* (Harvard University Press, 1936) traces how Aristotle's *scala naturae* became the organizing principle of medieval and early modern cosmology, providing not just a taxonomy of beings but a moral and aesthetic hierarchy. David C. Lindberg, *The Beginnings of Western Science* (University of Chicago Press, 1992), 45–70, documents how this framework survived even the early challenges of mechanistic philosophy. Robert Pasnau, *Thomas Aquinas on Human Nature* (Cambridge University Press, 2002) shows how Aquinas's synthesis created an even more robust system by grounding natural teleology in divine intellect—essentially adding a metaphysical guarantee to Aristotle's immanent ends.

form of its own.¹³ It is that which persists when all form is stripped away, the featureless ground upon which determinate forms are imposed.

Prime matter is Aristotle's reluctant acknowledgment of the **indeterminate ground**—the *Apeiron* that the Eleatics had banished and that Plato had exiled to the Receptacle.¹⁴ By making it pure potentiality, Aristotle attempts to **domesticate** it, rendering it passive and devoid of any positive character. Yet its very presence in the system is a vulnerability. It is the **unspeakable element** in an otherwise fully articulate ontology, the point where teleological explanation stops. Prime matter is, in NPN terms, a **domesticated *Apeiron***—an attempt to make the indeterminate into a determinate, albeit minimal, component of the system.

Here lies the critical error: Aristotle attempts to internalize the indeterminate to control it. In contrast, **First Principle 5 (Impotence Before the *Apeiron*)** and the **Ground Zero Principle (GZP)** explicitly externalize the *Apeiron* as the unknowable horizon of navigation.¹⁵ By trying to incorporate the ground as a conceptual placeholder (prime matter), Aristotle exposed his system to the very indeterminacy it sought to repress.

The Biological Anomaly: Demonizing the Neikos

If Prime Matter was the theoretical crack, Aristotle's late biological works reveal the empirical fissure. In his detailed studies of reproduction and anatomy, particularly in the *Generation of Animals*, Aristotle frequently encountered phenomena that defied teleological explanation. His honesty as an observer forced him to admit that the *telos* does not always win.

He categorized these failures under the concept of "**Material Necessity**" (*anangkē*). The most revealing instance is his treatment of **monstrosities** (*terata*)—birth defects or deviations from the species type. Aristotle defines a monster as "a mistake of purpose," occurring when the formal nature is unable to master the material nature.¹⁶ To Aristotle, these are broken instances of a fixed Being.

The NPN Analysis: In these moments, Aristotle is staring directly at the operation of the **Logos**, but he misinterprets the function of **Neikos** (Strife).

In the NPN framework, the "monstrosity" is not a failure of matter; it is the necessary operation of **Neikos**—the force of separation and differentiation.

¹³*Metaphysics* VII.3, 1029a10–26; VIII.1, 1042a25–32. The controversy over prime matter reveals the internal strain: Friedrich Solmsen, *Aristotle's System of the Physical World* (Cornell University Press, 1960) argues it is a necessary posit for Aristotle's system, while William Charlton, *Aristotle's Physics i and II* (Clarendon Press, 1970) contends Aristotle never clearly commits to it. Gill, *Aristotle on Substance* attempts to resolve this by treating prime matter as "relative," but this deepens the problem: if the ground is defined relationally, it cannot serve as the ultimate substrate. The textual ambiguity itself is the symptom of a conceptual wound: Aristotle needed the indeterminate ground to make change intelligible, but admitting it threatened the entire edifice of formal determination.

¹⁴Plato, *Timaeus* 48e–52d.

¹⁵Deutscher, *Neo-Pre-Platonic Naturalism*, 191

¹⁶*Generation of Animals* IV.3, 767b5–23.

- **Neikos (The Cause of Deviation):** Biology requires *Neikos* to introduce variation. It “cuts” the offspring away from the perfect identity of the parent, creating the “monstrosity” or mutation. Without this, there is no novelty, only eternal recurrence.
- **Philia (The Preservation of Success):** Evolution is the subsequent operation of **Philia**—the binding and passing along of those traits that successfully navigate the environment.

Note: This dialectic—where *Neikos* generates the raw variation and *Philia* preserves the functional alignment—is precisely the algorithmic core of **Natural Selection** that Charles Darwin would articulate 2,200 years later.¹⁷ Aristotle observed the engine of creation, but his synchronic framework forced him to label the fuel (variation) as “error,” effectively blinding Western thought to the mechanism of its own origin for two millennia.

The Humean Detonation: Empiricism vs. *Telos*

David Hume (1711–1776) delivered the external blow that exposed the fragility of Aristotle’s synchronic edifice. Hume’s radical empiricism insisted that all legitimate ideas must be traceable to impressions of sense experience.¹⁸ Applying this principle, Hume launched a two-pronged attack on Aristotelian foundations.

First, his analysis of **causation** dismantled the notion of necessary connection. We observe one event following another (constant conjunction), but we never observe a “necessary tie” between them. The idea of causal efficacy is a projection of the mind’s habit of expectation.¹⁹ This directly undermines Aristotle’s **efficient cause**, which relies on a natural, necessary connection between agent and effect.

Second, and more devastatingly, Hume formulated the **is-ought gap**. No set of descriptive statements about what *is* the case can logically entail a prescriptive statement about what *ought* to be the case.²⁰ This severs ethics from natural teleology. Aristotle’s *Nicomachean Ethics* is built on the premise that human *eudaimonia* is the *telos* of human nature—an “is” that directly implies an “ought” (we *ought* to act rationally to achieve our natural end). Hume showed this move to be logically invalid.²¹

¹⁷Charles Darwin, *On the Origin of Species by Means of Natural Selection* (John Murray, 1859); For the full development of *Philia* and *Neikos* as the fundamental drivers of evolutionary change, see Deutscher, *Neo-Pre-Platonic Naturalism*, 42–48.

¹⁸David Hume, *A Treatise of Human Nature*, ed. L. A. Selby-Bigge and P. H. Nidditch (1739; Oxford University Press, 1978), 1.1.1. For the connection between Hume’s empiricism and the dismantling of metaphysics, see A. J. Ayer, *Language, Truth, and Logic* (Gollancz, 1936).

¹⁹David Hume, *An Enquiry Concerning Human Understanding*, ed. L. A. Selby-Bigge and P. H. Nidditch (1748; Oxford University Press, 1975), Section 7. Helen Beebe, *Hume on Causation* (Routledge, 2006) offers the definitive modern analysis of this skepticism, showing how it dismantles not just efficient causation but the entire framework of necessary connection upon which Aristotle’s four causes depend.

²⁰Hume, *A Treatise of Human Nature*, 3.1.1.

²¹While some neo-Aristotelians like Rosalind Hursthouse, *On Virtue Ethics* (Oxford University Press, 1999) and Philippa Foot, *Natural Goodness* (Clarendon Press, 2001) attempt to rehabilitate virtue ethics post-Hume by divorcing it from metaphysical teleology, they succeed only by abandoning Aristotle’s core claim: that human function is

Hume's critique reveals the synchronic flaw: Aristotle's *teloi* are not found in the empirical phenomena; they are **interpretive frameworks** imposed upon them. The "purpose" of the heart is not an observable datum; it is an inference based on seeing its function within a larger, assumed teleological order.

The Evolutionary Problem: *Telos* vs. Open-Ended Becoming

If Hume attacked from the side of epistemology, Charles Darwin (1809–1882) attacked from the side of ontology. Darwin's theory of evolution by natural selection presented a coherent, empirically grounded account of the development of life **without invoking any pre-set ends**.²²

- **Adaptation Without Purpose:** The fit between an organism and its environment is not the result of a formal *telos* pulling development toward a perfect state. It is the result of **differential reproductive success** of random variations over deep time.²³
- **Contingency and Path-Dependence:** Evolutionary history is littered with accidents, dead ends, and exaptations. The human eye is not the "perfect" seeing organ implied by a teleological blueprint; it is a quirky, historically constrained solution full of design flaws.²⁴
- **No Fixed Species Essence:** Aristotelian species are defined by their eternal, unchanging forms. Evolution shows that species are temporary populations in constant flux.²⁵

Darwinism thus presents a vision of reality that is fundamentally **diachronic and open-ended**. The future is not pre-contained in the present; it is built step-by-step through contingent interactions. This is incompatible with Aristotle's synchronic teleology. Aristotle's system cannot accommodate **drift, exaptation, or emergent complexity** because these phenomena rely on a reality where the "end" is not given in advance but is continually generated by the process itself.

derivable from human nature. Their "naturalism" remains normative, smuggling in the "ought" they claim to derive from the "is." The is-ought gap remains unbridged in any system that starts with synchronic forms rather than diachronic navigation.

²²Darwin, *On the Origin of Species by Means of Natural Selection*.

²³The appearance of teleological organization is real, but Karen Neander, "Functions as Selected Effects: The Conceptual Analyst's Defense," *Philosophy of Science* 58, no. 2 (1991): 168–84 and Ruth Garrett Millikan, "In Defense of Proper Functions," *Philosophy of Science* 56, no. 2 (1989): 288–302 demonstrate that it emerges from selection history—a backward-looking causal story—not from forward-pulling final causes.

²⁴Daniel C. Dennett, *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (Simon & Schuster, 1995), 68–70. On the role of historical contingency over necessity, see Stephen Jay Gould, *Wonderful Life: The Burgess Shale and the Nature of History* (W. W. Norton & Company, 1989).

²⁵Allan Gotthelf, *Teleology, First Principles, and Scientific Method in Aristotle's Biology* (Oxford University Press, 2012) makes the strongest case for Aristotelian biology's compatibility with evolution. But his reliance on stable species essences reveals he hasn't actually escaped Aristotelian metaphysics—he's just tried to make it compatible with evolution by restricting its domain. This fails because population genetics shows there is no domain where essences remain stable. This is precisely what population genetics falsifies (Ernst Mayr, *The Growth of Biological Thought: Diversity, Evolution, and Inheritance* (Belknap Press, 1982)). Lennox, *Aristotle's Philosophy of Biology* similarly attempts to ground virtue in evolved nature, but fails because "human nature" is a statistical distribution in flux, not a fixed essence.

NPN's Diachronic Correction

The Neo-Pre-Platonic framework does not simply critique Aristotle; it offers a constructive alternative grounded in a different metaphysical orientation—one that starts from Becoming rather than Being.

First Principles: Becoming Before Being

The Neo-Pre-Platonic Naturalist framework begins with a fundamental ontological reorientation. **First Principle 2 (Diachronic Primacy)** states: “Being is a stabilized pattern within Becoming. Becoming is ontologically primary.”²⁶ This inverts the Aristotelian (and Platonic) priority of stable being over flux. In NPN, there is no realm of eternal forms or pre-set final causes. Reality is fundamentally **processual, dynamic, and unbounded**. What we perceive as stable “things” or “entities” are temporary, coherent patterns that persist within the overarching flux—like standing waves in a flowing river.²⁷

This principle immediately dissolves the Eleatic problem that Aristotle sought to solve. Change is not a puzzle requiring explanation by reference to unchanging forms—it is the default state of reality. The task shifts from explaining how change is possible to explaining how stability emerges within flux.

The “Eleatic Detonation” was not merely a mystical denial of motion, but a systematic **ban on the indeterminate ground**. By enforcing a strictly determinate discourse, the Logicians (from Parmenides to Gorgias) made change logically impossible because they refused to admit the *Apeiron* into the equations of Being.²⁸ NPN resolves this not by “explaining” change, but by **reclaiming the ground**. By establishing **Becoming as primary (FP2)** and acknowledging the **Apeiron as the necessary horizon (FP5)**, the flux is no longer a logical scandal to be domesticated by fixed forms, but the foundational medium of reality.²⁹

Hormē as Constitutive Push (FP6)

If Becoming is primary, what drives the formation and persistence of patterns? Aristotle's answer was *telos*—a pull from a future completion. NPN's answer is **Hormē—a constitutive push from the present condition**.

First Principle 6 (Primacy of the Hormē) defines *Hormē* as “the constitutive, non-negotiable ground of being an agent.”³⁰ It is the innate impulse of a system to strive, persist, and navigate its environment. Historically, this resonates with Spinoza's concept of *conatus*—the endeavor of a

²⁶Deutscher, *Neo-Pre-Platonic Naturalism*, 190.

²⁷See Gilbert Simondon, *L'individu Et Sa Genèse Physico-Biologique* (PUF, 1964) on individuation and metastability; cf. Alfred North Whitehead, *Process and Reality* (Macmillan, 1929) on “process” as the fundamental reality.

²⁸Deutscher, *The Rise of the Logicians*.

²⁹Deutscher, *Neo-Pre-Platonic Naturalism*, 4.

³⁰Deutscher, *Neo-Pre-Platonic Naturalism*, 192.

thing to persist in its own being—but NPN radicalizes it by placing it in an open, thermodynamic context.³¹ *Hormē* is not a desire for a specific end state; it is the **generic drive to continue being a coherent system** in the face of entropic dissolution.

Unlike *telos*, *Hormē* is **open-ended**. It does not specify a particular future state; it specifies a **mode of operation**: *keep going, maintain alignment, avoid dissolution*. The “ends” that emerge—finding food, building shelter, solving a problem, forming a bond—are **provisional satisfactions** of the *Hormē*, not its pre-defined goals.

The Confidence Gradient (C2) and Navigational Knowledge

Aristotle's epistemology was one of **recognition**: knowing is grasping the form inherent in the matter, aligning the mind with the timeless essence of things.³² This synchronic ideal of knowledge as certain, final, and complete is untenable in a diachronic reality.

NPN replaces it with **Corollary 2 (The Confidence Gradient)**: “*Epistēmē* is a provisional model measured on a gradient, not a binary of certainty.”³³ Knowledge is not the possession of truth but the **possession of high-fidelity, fallible maps** that guide action. This resonates with the Pragmatist tradition: beliefs are rules for action, and truth is the result of effective inquiry, not a mirror of nature.³⁴ The *Nous* is not a mirror reflecting reality but a **map-maker and pilot** for a system with *Hormē*.

The Dissolution of the *Telos-Hormē* False Binary: From Teleology to Teleonomy

A potential objection arises: if *Hormē* drives systems toward certain outcomes (e.g., an animal seeks food), doesn't that look like teleology? NPN clarifies this through the crucial distinction between **formal teleology** (Aristotle's pre-set pull) and **functional teleonomy** (emergent, apparent purpose).

In NPN, **apparent purpose** is an emergent property of *Hormē*-driven systems operating via **cybernetic feedback loops**. A bird building a nest is not fulfilling a pre-inscribed “nest-building *telos*.” It is executing a complex set of behaviors driven by its *Hormē* and corrected by environmental feedback.

- **Mechanism of Correction:** The system acts (Push), receives feedback (Error), and corrects.

³¹Baruch Spinoza, *Ethics*, trans. Edwin Curley (1677; Princeton University Press, 1985), *Ethics* III, Prop. 6.

³²*On the Soul* III.4, 429a10–29.

³³Deutscher, *Neo-Pre-Platonic Naturalism*, 192.

³⁴See Charles Sanders Peirce, “The Fixation of Belief,” *Popular Science Monthly* 12 (1877): 1–15; John Dewey, *The Quest for Certainty: A Study of the Relation of Knowledge and Action* (Minton, Balch & Company, 1929).

- **The Illusion of Pull:** Colin S. Pittendrigh³⁵ coined “teleonomy” to distinguish this cybernetic goal-directedness from Aristotelian metaphysics. Ernst Mayr³⁶ formalized this, showing that apparent purpose reduces to programs shaped by past selection. Arturo Rosenblueth et al.³⁷ provided the foundational analysis: negative feedback loops create the *appearance* of pull from a goal state, but the causal arrow runs entirely from present error-detection backward to adjustment mechanisms. The “goal” is a **virtual attractor** generated by the system’s internal models.

Thus, NPN **explains teleological-like phenomena without teleological metaphysics**. It shows how purpose emerges from push, not pull.

Lexical Irony: Aristotle’s *Energeia* vs. NPN’s *Energeia*

A telling terminological shift underscores the metaphysical divide. For Aristotle, *energeia* signifies **actuality**—the state of completion and fulfillment of a potential, the *telos* realized. It is a **synchronic state of being**.

In the NPN Navigator Protocol, *Energeia* is **Step 9: “Being-at-Work”**—the active implementation of a model, the deployment of a strategy into the dynamic *Archē*.³⁸ It is a **diachronic activity of becoming**.

This distinction is not merely semantic. For Aristotle, *energeia* is the perfected state that gives meaning to the process; the house-being-built exists *for the sake of* the completed house.³⁹ This makes activity derivative of product. Even where David Charles⁴⁰ argues Aristotle allows for ongoing activity, it remains tethered to a timeless form. In NPN, the navigator is never “finished” because the territory itself is in flux. The shift from static completion to dynamic implementation captures the entire metaphysical correction.

Why the Shift from Pull to Push Matters

The move from Aristotelian teleology to NPN navigation is not merely a change in terminology. It has profound implications for how we conceive of time, knowledge, ethics, politics, and science.

³⁵“Adaptation, Natural Selection, and Behavior,” in *Behavior and Evolution*, ed. A. Roe and G. G. Simpson (Yale University Press, 1958).

³⁶“Teleological and Teleonomic, a New Analysis,” *Boston Studies in the Philosophy of Science* 14 (1974): 91–117.

³⁷“Behavior, Purpose and Teleology,” *Philosophy of Science* 10, no. 1 (1943): 18–24.

³⁸Deutscher, *Neo-Pre-Platonic Naturalism*, 243.

³⁹Lear, *Aristotle*, 34–42.

⁴⁰*Aristotle on Meaning and Essence* (Clarendon Press, 2000).

Metaphysical: Time, Novelty, and the Open Future

Aristotle's synchronic pull **flattens time**. The future is already logically contained in the present as potentiality destined for a specific actuality. Time is merely the medium through which the pre-ordained unfolds. This leaves no room for **genuine novelty**—only the revelation of what was already implicit. This view anticipates the “Block Universe” of classical physics, where time is an illusion and the future is fixed.⁴¹

NPN's diachronic push **takes time seriously**. The future is **open and under construction**. The *Hormē* drives systems into a future that is not pre-scripted but must be navigated through a series of contingent interactions. **Novelty is not only possible but expected**, as systems encounter unforeseen challenges and generate new solutions. This metaphysical orientation aligns with process philosophy and modern critiques of the “frozen” universe, asserting that time is real and creative.

Epistemological: From Recognition to Construction and Revision

The shift from *telos* to *Hormē* transforms the very nature of knowledge. For Aristotle, the pinnacle of knowledge (*theōria*) is the contemplative grasp of eternal truths—the forms and final causes.⁴² This is what Dewey famously called the “**Spectator Theory of Knowledge**”—an idealization of certainty where the mind mirrors a static reality.⁴³

For NPN, knowledge is **participatory and instrumental**. The *Nous* is an organ of navigation, not contemplation. Its logic (*Somatic logos*) is “an evolved functional alignment with the *Logos* of the *Archē*.”⁴⁴ We know not by beholding essences but by **building and testing maps** that allow us to steer. This makes empiricism and fallibilism not threats to be resisted, but **core features of the knowing process**. The Confidence Gradient formalizes the idea that our best maps are always provisional, subject to revision in the next Popperian feedback loop.⁴⁵

⁴¹Lee Smolin, *Time Reborn: From the Crisis in Physics to the Future of the Universe* (Houghton Mifflin Harcourt, 2013) argues that modern physics inherited this “frozen time” assumption from the Platonic/Aristotelian tradition. Even Ursula Coope, *Time for Aristotle: Physics IV. 10-14* (Oxford University Press, 2005)'s sophisticated defense of Aristotelian temporality cannot escape this synchronic structure: her analysis of *Physics* IV.10–14 (pp. 89–112) shows that for Aristotle, time remains the measure of change toward predetermined ends, not the medium of genuine creativity. Because he posits actuality as ontologically prior to process, the future is treated as a destination to be reached rather than a horizon to be constructed. Henri Bergson, *Creative Evolution*, trans. Arthur Mitchell (1907; Henry Holt; Company, 1911) provides the necessary correction: lived duration involves genuine creativity that cannot be reduced to the geometric succession of states.

⁴²*Nicomachean Ethics* X.7, 1177a12–1178a8.

⁴³Dewey, *The Quest for Certainty* diagnosed this as the central pathology of Greek philosophy: the valorization of contemplation over practical engagement. Aristotle's epistemology remains captive to this ideal—knowledge is ultimately recognition of pre-existing essences rather than the construction of navigational tools.

⁴⁴Deutscher, *Neo-Pre-Platonic Naturalism*, 193.

⁴⁵Karl Popper, *The Logic of Scientific Discovery* (Basic Books, 1959); Deutscher, *Neo-Pre-Platonic Naturalism*, 241–42.

Ethical: From Fulfilling Essence to Skillful Navigation

Aristotelian virtue ethics is the moral corollary of his teleology. Human flourishing (*eudaimonia*) is the activity of the soul in accordance with reason, which is the fulfillment of the human *telos*.⁴⁶ Virtues are stable character traits that reliably lead to this end. This is an ethics of **essence-realization**.

NPN, via **Theorem T4 (Ethical Isomorphism)**, collapses the is-ought gap by showing that for a system with *Hormē*, “epistemic error and ethical vice are functionally identical states of misalignment with the *Logos*.”⁴⁷ “Good” action is action that successfully fulfills the system’s *Hormē* within the constraints of reality.

This results in a **navigational virtue ethics**. Unlike Aristotelian naturalism, which relies on a fixed human essence, NPN recognizes that human nature is a moving target—a statistical distribution in constant flux rather than a determinate kind.⁴⁸ Virtue is not the realization of a pre-given human essence, but the **cultivated skill of navigating reality effectively**—the state of being “Rightly Cut” (*Dikaiosynē*) so as to minimize entropic friction.⁴⁹

Political Isomorphism: From Hierarchical Polis to Distributed Network

The metaphysical divergence inevitably reshapes political theory. Aristotle’s politics is an extension of his biological hierarchy: the *Polis* is a natural entity, prior to the individual, structured by fixed roles (ruler, citizen, slave) determined by natural capacity.⁵⁰

The “Smoking Gun” of Natural Slavery: The doctrine of natural slavery is not an incidental moral failing but the inevitable consequence of synchronic teleology applied to human organization.⁵¹

NPN, grounded in *Hormē* and the *Apeiron*, rejects this static hierarchy in favor of a **Networked Navigation**. Because the *Apeiron* is fundamentally indeterminate and the *Archē* is inherently in

⁴⁶*Nicomachean Ethics* I.7, 1098a7–18.

⁴⁷Deutscher, *Neo-Pre-Platonic Naturalism*, 197.

⁴⁸John McDowell, “Two Sorts of Naturalism,” in *Virtues and Reasons: Philippa Foot and Moral Theory*, ed. Rosalind Hursthouse et al. (Clarendon Press, 1995) attempts to naturalize virtue as a “perceptual skill,” but still grounds it in a normative telos. Hursthouse, *On Virtue Ethics* explicitly defends the “naturalistic fallacy” by arguing that “good” depends on the kind of being evaluated. But this fails because, as Darwin showed, there is no fixed “kind” with a determinate function. The only defensible naturalism grounds normativity in the *formal requirements of navigation itself*—not in what humans “are” (essence), but in what any bounded agent *must do* to persist in an indeterminate field.

⁴⁹Deutscher, *Neo-Pre-Platonic Naturalism*, 245.

⁵⁰*Politics* I.2, 1252a–1253a; I.5, 1254a–1255a.

⁵¹Once the telos of “being ruled” is inscribed into a class of human forms, the hierarchy becomes unfalsifiable. Johnson, *Aristotle on Teleology* attempts to soften this by arguing Aristotle’s criteria are restrictive, and Christopher Shields, *Aristotle*, 2nd ed. (Routledge, 2014) tries to contextualize it historically. However, the problem is structural: a synchronic teleology cannot distinguish between “this is how things are” and “this is how things must be.” It fossilizes the present social order as destiny. There is no space for the empirical discovery that enslaved people are *not* naturally suited for slavery, because the system defines their nature by their current function.

flux, no single central node can possess a perfect map. Survival requires **distributed sensing and processing**.

- **Universal Agency:** Every individual possesses *Hormē* and *Nous*, making them a sensor-actuator node in the collective network.
- **The Polis as Convoy:** Society is not a static body but a **dynamic convoy** navigating history.
- **Democracy as Computation:** Democratic feedback mechanisms are not just “rights” but **computational necessities**—they allow the network to aggregate local knowledge to correct the collective map.

Scientific: From Final Causes to Functional Drift

Finally, the shift enables a seamless integration with modern science. Aristotle's final causes were expunged from physics by the Newtonian revolution and from biology by the Darwinian revolution. Science thrives on efficient-material explanation within a contingent, historical framework.

NPN provides the **metaphysical underpinning** for this scientific worldview. It explains why final causes are absent: because reality is diachronic and *Hormē*-driven, not synchronic and *telos*-pulled. The “functions” studied in biology are not formal *teloi* but **stable roles that have emerged** because they successfully satisfy the *Hormē* of the organism within its evolutionary niche.⁵²

In this view, science itself is the ultimate expression of the *Hormē* of the *Nous*—the drive to build ever-better maps of a dynamic territory bounded by a silent *Apeiron*.

Aristotle in the NPN Phylogeny

Seen through the lens of NPN's crisis-response taxonomy, Aristotle's philosophy appears not as a timeless truth, but as the apex of a particular historical strategy—one that ultimately could not withstand the return of the repressed indeterminate.

⁵²Stuart S. Glennan, “Mechanisms and the Nature of Causation,” *Philosophy of Science* 63, no. 1 (1996): 49–71 and Peter Machamer et al., “Thinking about Mechanisms,” *Philosophy of Science* 67, no. 1 (2000): 1–25 developed the “new mechanist” philosophy to explain biological function without teleology. Robert Cummins, “Functional Analysis,” *The Journal of Philosophy* 72, no. 20 (1975): 741–65 formalized this as “causal-role” function. NPN vindicates this view: the “function” of the heart is its role in navigational success, selected because ancestors with such hearts survived. Function is *backward-looking* (selection history) and *present-maintaining*, never forward-pulling.

Aristotle's Place in the Crisis-Response History

Seen through the lens of the Eleatic crisis and its aftermath—as chronicled in *The Rise of the Logicians*—Aristotle's role comes into sharp focus.⁵³ He is not a direct, simple branch like Epicureanism or Stoicism. He is the **apex of the ancient Reconstructive exit**. After the Logicians (Xenophanes, Parmenides, Zeno, Gorgias) had demolished the pre-Socratic project, and after Socrates had pioneered the navigational exit, Plato attempted a reconstruction via transcendent Forms. Aristotle inherited this project and **immanentized it**, grounding the forms within nature itself and systematizing the explanation of change through hylomorphism and teleology.

His was the most successful attempt to **build a new, stable ground** after the old one had been shattered. For two millennia, it worked. It provided a complete, satisfying answer that domesticated the Eleatic crisis by making change logical and the world purposeful.

Why His System Was Doomed: The Return of the Repressed Apeiron

Yet, as NPN's **First Principle 5 (Impotence Before the Apeiron)** asserts, “Logical operation cannot be empirically grounded within the unknowable *Apeiron*.”⁵⁴ Any system that attempts to ground itself in a fully determinate, speakable foundation is inherently unstable. Aristotle's system tried to **solve the crisis by providing a determinate ground** (teleological forms). It repressed the indeterminate *Apeiron* into the passive concept of prime matter. But the repressed returned through internal incoherence (the prime matter debate), external empirical critique (Hume), and ontological revolution (Darwin).

Distinction: NPN vs. Historical Neoplatonism

It is crucial to distinguish the **Neo-Pre-Platonic** framework from historical **Neoplatonism** (e.g., Plotinus, Proclus). Historical Neoplatonism was fundamentally **emanationist**: reality flows *down* from a static, transcendent “One.”⁵⁵

NPN is **emergentist**: order pushes *up* from the collision of *Hormē* and the *Archē*. It looks back to the **Pre-Platonic** insights of Anaximander (*Apeiron*), Heraclitus (flux) and the navigational skepticism of Socrates, bypassing the Platonic/Aristotelian fixation on static forms. Where Plotinus offers a ladder to climb out of time, NPN offers a compass to navigate through it.

⁵³Deutscher, *The Rise of the Logicians*.

⁵⁴Deutscher, *Neo-Pre-Platonic Naturalism*, 191.

⁵⁵Plotinus, *The Enneads*, trans. Stephen MacKenna (Penguin Classics, 1991), *Enneads* V.2.1 establishes this downward hierarchy. Proclus, *The Elements of Theology*, trans. E. R. Dodds (Clarendon Press, 1963), *Elements of Theology*, Prop. 25–39 systematizes it. This remains fundamentally synchronic: the hierarchy is eternal. Contemporary attempts to revive hylomorphism face the same problem: Kathrin Koslicki, *The Structure of Objects* (Oxford University Press, 2008) defends the priority of structure (form) over process, arguing that objects are “complex wholes.” But this recreates the synchronic trap: if structure is prior to process, genuine historical contingency becomes impossible.

NPN as the Successor System: From Reconstruction to Navigation

NPN does not attempt to solve the crisis Aristotle faced. Instead, it **accepts the crisis as its First Principle**. FP5 formally acknowledges the unspeakable *Apeiron* as the horizon of thought. From this acceptance, NPN builds a philosophy designed not for a world of static being, but for a world of Becoming.

Table 1: The Aristotelian-NPN Shift

Aristotle's Synchronic System	NPN's Diachronic Correction	Core Shift
Telos (Final Cause) – Pre-set pull from future completion.	Hormē – Constitutive push from present striving.	Pull → Push
Form (Eidos) – Eternal, determinate essence.	Stabilized Pattern – Temporary coherence within flux (FP2).	Being → Becoming
Natural Order – Entropy ignored; order is default.	Negentropy – Order is expensive work against decay (T7).	Given → Earned
Energeia – Actuality, state of fulfillment.	Energeia (Step 9) – Active implementation, being-at-work.	Completion → Process
Knowledge (Theōria) – Contemplative grasp of essences.	Confidence Gradient (C2) – Provisional models for navigation.	Certainty → Gradient
Political Hierarchy – Fixed roles in a natural <i>Polis</i> .	Networked Navigation – Distributed agency in a dynamic convoy.	Pyramid → Network
Prime Matter – Domesticated, passive <i>Apeiron</i> .	Apeiron (FP5) – Acknowledged indeterminate horizon.	Repression → Acceptance

In doing so, NPN completes the project that Socrates began but could not systematize: it provides the **first-principles framework and the recursive protocol** for a life—and a philosophy—of “long seeking” within a groundless reality. Aristotle gave us the blueprint; NPN gives us the compass and the sailing manual for a sea without shores.

Conclusion: From Blueprint to Compass

Aristotle of Stagira gave Western thought its most comprehensive and enduring **blueprint for reality**. His vision of a teleological cosmos, where every entity strives toward its pre-ordained

perfection, provided meaning, order, and intellectual satisfaction for centuries. It was the definitive answer to the Eleatic challenge, a masterful synthesis that seemed to reconcile flux with permanence.

That blueprint, we now know, was a magnificent projection. Hume's empiricism showed that its foundational concepts were not read from nature but read into it. Darwin's theory of evolution revealed a natural world not of destined ends, but of contingent, meandering pathways. Thermodynamics revealed that order is not a natural resting place, but a temporary victory against the tide of entropy. The blueprint was for a universe that does not exist.

The Neo-Pre-Platonic Naturalist framework does not offer a new blueprint. It offers a **compass and a protocol**. Its foundational move is to abandon the quest for a synchronic, teleological ground and to embrace the ontological primacy of Becoming. By replacing Aristotle's *telos*—a pull from a finished future—with *Hormē*—a constitutive push from an ongoing present—NPN aligns philosophy with the dynamic, open-ended, and evolutionary character of reality as we now understand it.

This shift is more than a technical adjustment in metaphysics. It reshapes epistemology from contemplation to navigation, ethics from essence-fulfillment to skillful alignment, politics from hierarchy to distributed networking, and our entire stance toward a world that is not a puzzle to be solved but a territory to be sailed. Aristotle sought to bring the voyage to an end by revealing its destined port. NPN recognizes that there is no final port, only the perpetual, worthy, and necessary practice of navigation itself. In making that recognition its starting point, it provides the first philosophy truly adequate to a world of Becoming.

*This paper is part of the larger systematic inquiry developed in *Neo-Pre-Platonic Naturalism* (2025), which derives these definitions of agency and value from the fundamental logic of distinction.

References

- Ayer, A. J. *Language, Truth, and Logic*. Gollancz, 1936.
- Balme, D. M. "Development of Biology in Aristotle and Theophrastus: Theory of Spontaneous Generation." In *Aristotle and the Later Tradition*, edited by I. Düring. Almqvist & Wiksell, 1962.
- Beebe, Helen. *Hume on Causation*. Routledge, 2006.
- Bergson, Henri. *Creative Evolution*. Translated by Arthur Mitchell. 1907; Henry Holt; Company, 1911.
- Charles, David. *Aristotle on Meaning and Essence*. Clarendon Press, 2000.
- Charlton, William. *Aristotle's Physics i and II*. Clarendon Press, 1970.

- Coope, Ursula. *Time for Aristotle: Physics IV. 10-14*. Oxford University Press, 2005.
- Cummins, Robert. "Functional Analysis." *The Journal of Philosophy* 72, no. 20 (1975): 741–65.
- Curd, Patricia. *The Legacy of Parmenides: Eleatic Monism and Later Presocratic Thought*. Parmenides Publishing, 2004.
- Darwin, Charles. *On the Origin of Species by Means of Natural Selection*. John Murray, 1859.
- Deacon, Terrence W. *Incomplete Nature: How Mind Emerged from Matter*. W. W. Norton & Company, 2011.
- Dennett, Daniel C. *Darwin's Dangerous Idea: Evolution and the Meanings of Life*. Simon & Schuster, 1995.
- Deutscher, Eli Adam. *Neo-Pre-Platonic Naturalism: A First-Principles Framework for Reality, Mind, and Knowledge*. Pre-Release First Edition. Neo-Pre-Platonic Press, 2025.
- Deutscher, Eli Adam. *The Rise of the Logicians: From Xenophanes to Socrates—and How They Almost Killed Philosophy*. 2026. <https://doi.org/10.5281/zenodo.18263959>.
- Dewey, John. *The Quest for Certainty: A Study of the Relation of Knowledge and Action*. Minton, Balch & Company, 1929.
- Foot, Philippa. *Natural Goodness*. Clarendon Press, 2001.
- Gill, Mary Louise. *Aristotle on Substance: The Paradox of Unity*. Princeton University Press, 1989.
- Glennan, Stuart S. "Mechanisms and the Nature of Causation." *Philosophy of Science* 63, no. 1 (1996): 49–71.
- Gotthelf, Allan. *Teleology, First Principles, and Scientific Method in Aristotle's Biology*. Oxford University Press, 2012.
- Gould, Stephen Jay. *Wonderful Life: The Burgess Shale and the Nature of History*. W. W. Norton & Company, 1989.
- Hume, David. *A Treatise of Human Nature*. Edited by L. A. Selby-Bigge and P. H. Nidditch. 1739; Oxford University Press, 1978.
- Hume, David. *An Enquiry Concerning Human Understanding*. Edited by L. A. Selby-Bigge and P. H. Nidditch. 1748; Oxford University Press, 1975.
- Hursthouse, Rosalind. *On Virtue Ethics*. Oxford University Press, 1999.
- Johansen, T. K. *Plato's Natural Philosophy: A Study of the Timaeus-Critias*. Cambridge University Press, 2004.
- Johnson, Monte Ransome. *Aristotle on Teleology*. Oxford University Press, 2005.
- Kirk, G. S., J. E. Raven, and M. Schofield. *The Presocratic Philosophers*. Cambridge University Press, 1983.
- Kirk, G. S., J. E. Raven, and M. Schofield. *The Presocratic Philosophers: A Critical History with a Selection of Texts*. 2nd ed. Cambridge University Press, 1983.
- Koslicki, Kathrin. *The Structure of Objects*. Oxford University Press, 2008.
- Lear, Jonathan. *Aristotle: The Desire to Understand*. Cambridge University Press, 1988.
- Lennox, James G. *Aristotle's Philosophy of Biology*. Cambridge University Press, 2001.
- Lindberg, David C. *The Beginnings of Western Science*. University of Chicago Press, 1992.

- Lovejoy, Arthur O. *The Great Chain of Being: A Study of the History of an Idea*. Harvard University Press, 1936.
- Machamer, Peter, Lindley Darden, and Carl F. Craver. "Thinking about Mechanisms." *Philosophy of Science* 67, no. 1 (2000): 1–25.
- Mayr, Ernst. "Teleological and Teleonomic, a New Analysis." *Boston Studies in the Philosophy of Science* 14 (1974): 91–117.
- Mayr, Ernst. *The Growth of Biological Thought: Diversity, Evolution, and Inheritance*. Belknap Press, 1982.
- McDowell, John. "Two Sorts of Naturalism." In *Virtues and Reasons: Philippa Foot and Moral Theory*, edited by Rosalind Hursthouse, Gavin Lawrence, and Warren Quinn. Clarendon Press, 1995.
- Millikan, Ruth Garrett. "In Defense of Proper Functions." *Philosophy of Science* 56, no. 2 (1989): 288–302.
- Neander, Karen. "Functions as Selected Effects: The Conceptual Analyst's Defense." *Philosophy of Science* 58, no. 2 (1991): 168–84.
- Pasnau, Robert. *Thomas Aquinas on Human Nature*. Cambridge University Press, 2002.
- Peirce, Charles Sanders. "The Fixation of Belief." *Popular Science Monthly* 12 (1877): 1–15.
- Pittendrigh, Colin S. "Adaptation, Natural Selection, and Behavior." In *Behavior and Evolution*, edited by A. Roe and G. G. Simpson. Yale University Press, 1958.
- Plotinus. *The Enneads*. Translated by Stephen MacKenna. Penguin Classics, 1991.
- Popper, Karl. *The Logic of Scientific Discovery*. Basic Books, 1959.
- Prigogine, Ilya, and Isabelle Stengers. *Order Out of Chaos: Man's New Dialogue with Nature*. Bantam Books, 1984.
- Proclus. *The Elements of Theology*. Translated by E. R. Dodds. Clarendon Press, 1963.
- Rosenblueth, Arturo, Norbert Wiener, and Julian Bigelow. "Behavior, Purpose and Teleology." *Philosophy of Science* 10, no. 1 (1943): 18–24.
- Ross, W. D. *Aristotle*. Methuen & Co., 1923.
- Shields, Christopher. *Aristotle*. 2nd ed. Routledge, 2014.
- Simondon, Gilbert. *L'individu Et Sa Genèse Physico-Biologique*. PUF, 1964.
- Smolin, Lee. *Time Reborn: From the Crisis in Physics to the Future of the Universe*. Houghton Mifflin Harcourt, 2013.
- Solmsen, Friedrich. *Aristotle's System of the Physical World*. Cornell University Press, 1960.
- Spinoza, Baruch. *Ethics*. Translated by Edwin Curley. 1677; Princeton University Press, 1985.
- Whitehead, Alfred North. *Process and Reality*. Macmillan, 1929.