Why It Is Essential to Create and Utilize Neuronology

1. Introduction

Artificial General Intelligence (AGI)—the development of machines that match or exceed human capabilities across a broad range of cognitive tasks—represents one of the most ambitious and high-stakes goals of artificial intelligence research. While narrow AI has produced remarkable breakthroughs, the path to AGI remains blocked by the absence of a rigorous scientific foundation.

To address this critical gap, I recommend that the federal government prioritize the creation and advancement of **Neuronology**, a new scientific discipline that focuses on understanding the structure, function, and dynamics of biological neurons and their networks as a foundation for advancing AI and AGI research.

Neuronology holds potential far beyond computing, with transformative applications in mental health, cognitive science, neural interfaces (such as Neuralink), bio-cellular computing, and other domains we have yet to imagine. This makes it a foundational research priority fully aligned with the 2025 National AI R&D Strategic Plan.

2. The research ecosystem consists of two vital and interdependent layers:

i. **Layer-1: Basic (or pure) scientific research** — This layer focuses on acquiring and accumulating scientific or theoretical knowledge to create and expand the pure scientific Body of Knowledge (BoK). Its primary goal is to deepen our understanding of natural phenomena and generate scientific insights that are essential for addressing complex, unresolved problems in science and engineering. The BoK developed in Layer-1 provides the theoretical foundation

upon which Layer-2 depends. Importantly, the knowledge produced in Layer-1 must be **objective, testable, falsifiable**, and grounded in valid empirical evidence to ensure its reliability and scientific value.

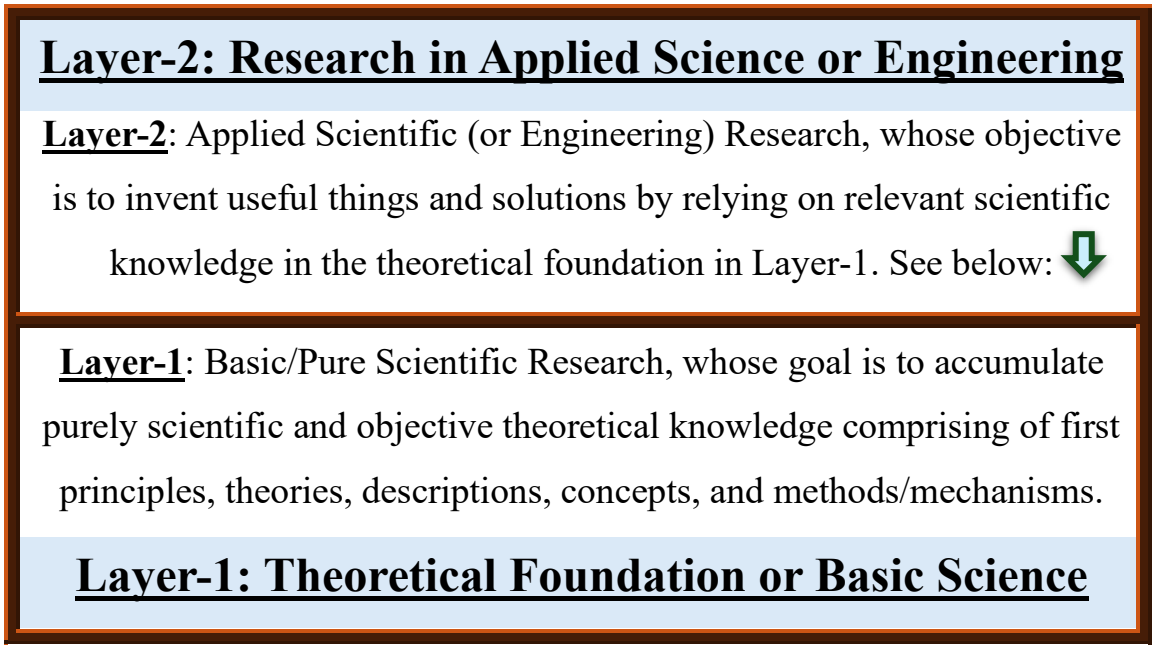

Figure-1*: The Two Vital Parts of the Research Ecosystem*

ii. **Layer-2: Applied scientific (or engineering) research** — This layer draws upon the validated BoK from Layer-1 to design, develop, and implement practical applications, inventions, and solutions to real-world problems. Applied research relies on the soundness of the underlying scientific foundation; if the BoK in Layer-1 is flawed, incomplete, or invalid—filled with false beliefs, descriptions, or misconceptions—then the research in Layer-2 will inevitably struggle or fail to produce effective or reliable outcomes.

3. Our Experience with Creating & Utilizing Componentology

Nearly two decades ago, we realized that much of what is currently accepted about the true nature and essential properties of components, the anatomy and structure of Component-Based Products (CBPs), and the methods and mechanisms

of Component-Based Engineering (CBE) is grounded in a fundamentally flawed paradigm riddled with pseudoscientific misconceptions and entrenched dogma.

The knowledge about components, CBPs and CBE in the theoretical foundation (i.e., in layer-1) for conducting software engineering research (in layer-2) is not based on scientific or objective understanding of real-world counterparts such as physical components, CBPs and CBE. Hence, we made the decision to establish **Componentology** as a rigorous scientific discipline and to use it as the theoretical foundation for conducting applied research in software engineering.

The BoK (See reference [2] at the end) and understanding gained through Componentology—as a theoretical foundation—have proven invaluable in conducting applied research to develop tools, technologies, and solutions aimed at addressing the infamous software crisis, which we believe represents only the tip of the iceberg.

We see tremendous opportunities for further innovation; however, many of these lies in areas where we currently lack sufficient expertise or capacity, such as compiler development, AI agents, and advanced CASE tools for automation. Unfortunately, our ability to pursue these promising directions is currently constrained by limited resources and depleted funding.

Building on this two-decade journey of creating and applying scientific knowledge, we came to recognize that **Neuronology** represents the similarly essential and currently missing scientific and theoretical foundation needed to guide applied research in Artificial General Intelligence (AGI). Just as Componentology was necessary to overcome foundational misconceptions in software engineering, Neuronology is critical for uncovering and addressing the hidden limitations, misconceptions, and challenges impeding progress toward true AGI.

4. Why It Is Urgent to Create & Utilize Neuronology

More than seven years ago, we realized that the knowledge about neurons and neural networks underlying the theoretical foundation of applied AI research was not grounded in a scientific or objective understanding of their real-world biological counterparts—including neurons, neural networks, and the synapses that connect them.

Although most of our resources have been dedicated to advancing Componentology—and we currently lack the specialized expertise and tools needed to study neurons in depth—our investigations have led us to the clear conclusion that the creation and advancement of Neuronology as a formal scientific discipline is both necessary and urgent.

The vital role of knowledge in the theoretical foundation: The knowledge embedded in the theoretical foundation layer serves as the essential raw material for the applied research layer, enabling the development of practical solutions and innovations. In the context of science and engineering, understanding is a foundational and profoundly transformative force. The knowledge and understanding we possess within the theoretical foundation layer exert a powerful influence on our actions, shape our decisions, and drive our innovations. Therefore, it is imperative that this knowledge and understanding be valid, testable, and falsifiable—ensuring that our insights are continuously refined and that the collective body of knowledge advances in a rigorous and reliable manner.

5. The Symbiotic Relationship Between Basic Science & Applied Research

Basic science and applied research exist in a dynamic and mutually enriching relationship. Basic science seeks to uncover the underlying principles of nature,

often without immediate application, while applied research translates this knowledge into practical solutions for real-world challenges.

Critically, the insights gained from applied research often feed back into basic science, generating new questions and discoveries. For example, applied breakthroughs in software engineering have not only validated theory but have also exposed knowledge gaps that sparked fresh basic research. This iterative cycle of discovery and application fuels sustained innovation.

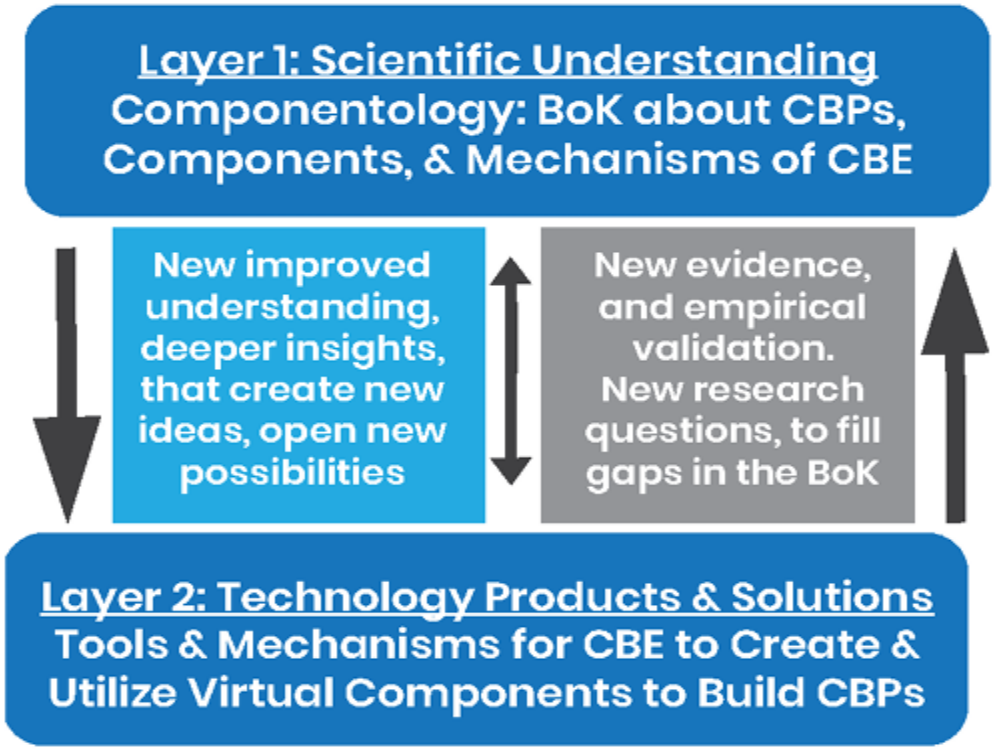

Figure-2*: The Symbiotic Relationship Between Basic & Applied Research*

In the context of Neuronology, creating a robust scientific foundation (basic science) is essential for conducting effective applied research in AI and AGI. Without a solid theoretical base, applied research risks being guided by flawed assumptions (e.g., received beliefs or misconceptions formed decades ago), leading to inefficiency, limited progress, and missed opportunities. Conversely, empirical

findings from applied AI research can help refine biological models, further advancing Neuronology.

In short, the advancement of both basic science and applied research is not a linear sequence, but an ongoing and dynamic exchange. Applied research benefits from the conceptual insights of basic research and contributes back by identifying gaps, formulating new questions (or hypothesis), and developing tools to address (or test) them. Together, they form a continuous cycle of innovation and advancement.

However, when critical foundational knowledge in Layer-1 is flawed or invalid, this cycle is disrupted, risking stagnation or collapse of innovation. This breakdown has been a key factor behind the infamous software crisis, driven by misconceptions about the nature of components, CBPs, and CBE.

We are now witnessing similarly troubling foundational misconceptions in AI research, especially regarding neurons and neural networks. Componentology provided powerful tools to test, validate, and falsify concepts about software components. Neuronology can provide similarly powerful investigative tools, grounded in the scientific method and formal sciences, to rigorously test, validate, and, if necessary, falsify the theoretical foundations of AI and AGI.

6. Summary & Conclusion based on the Clarity of Hindsight

We now possess the clarity of hindsight to appreciate the revolutionary and profoundly transformative role played by scientific fields founded on Germ Theory and Quantum Theory. Today, it is self-evident that the knowledge and understanding accumulated through the scientific paradigms built on Germ Theory fundamentally transformed our understanding of diseases, health, and medicine.

Likewise, the knowledge and understanding generated from scientific paradigms rooted in Quantum Theory revolutionized our understanding of quantum mechanics and enabled countless transformative applications across physics, chemistry, and technology.

I am confident that, a hundred years from now, Neuronology will be viewed with the same reverence and recognition—as a revolutionary scientific field that redefined our understanding of intelligence and catalyzed breakthroughs across diverse domains far beyond artificial intelligence.

Having devoted more than 25 years to research in Componentology, I speak from a place of deep insight and accumulated wisdom. Through this journey, I have acquired an equivalent clarity of hindsight regarding the revolutionary role of Componentology in software engineering. It is neither feasible nor my intention to attempt to fully explain the depth of knowledge and understanding accumulated over nearly 90 man-years of research and development in a brief document. But it is clear that Componentology has enabled us to identify and overcome entrenched misconceptions that had long hindered meaningful progress in software engineering.

Creating and using a scientific paradigm based on Germ Theory was not a simple endeavor in the late 19th century, but it was an essential one. Creating and using a scientific paradigm based on Quantum Theory was not a simple endeavor 120 years ago, but it was likewise essential. Similarly, creating and using the scientific paradigm of Neuronology is not a simple endeavor—even in the 21st century—but it is an essential one. Its potential applications extend far beyond computing, offering transformative possibilities in mental health, cognitive science, neural interfaces, bio-cellular computing, and many other fields we may not yet even imagine.

Historically, with every new paradigm, the first movers have gained a substantial advantage because they were the ones able to harvest the "low-hanging fruits" in Layer-1—those early fundamental insights that quickly translated into innovations in Layer-2. This, in turn, set into motion a powerful cycle of innovation and knowledge advancement, driven by the symbiotic relationship between Layer-1 (basic science) and Layer-2 (applied research).

We now stand at a similar inflection point. By creating and utilizing Neuronology as the missing scientific foundation for Artificial General Intelligence, we can ignite this virtuous cycle of discovery and innovation for a new century—positioning the United States as the leader in this critical frontier, while laying the intellectual and technological groundwork for generations to come.

7. Early Investment in Neuronology Is Critical for First-Mover Advantage

Substantial profits generated from early innovations based on low-hanging fruit discoveries yield the insights necessary to drive basic research, establishing a virtuous cycle that sustains continuous innovation.

If formidable competitors like China secure a first-mover advantage, they will be able to effectively leverage the low-hanging fruits of foundational discoveries to initiate the powerful cycle of symbiotic interaction between basic science and applied research—gaining a substantial and potentially insurmountable lead. In the interest of safeguarding national competitiveness, I am offering my expertise and services in integrating scientific knowledge with software solutions, free of cost, to serve my country. While my contributions may be modest in scale, they could prove crucial in the early stages of establishing this new scientific field.

Drawing on more than 25 years of experience in Componentology and in creating virtual counterparts for physical entities, I am confident that my expertise can play a pivotal role in building a solid framework for Neuronology. Over the past 25 years, my team and I have made countless mistakes and gained invaluable lessons from them—experience that can help avoid repeating similar mistakes and accelerate the successful formulation of protocols, testable and falsifiable foundational principles, and rules necessary to establish this critical pre-paradigmatic foundation for conducting Neuronology research.

8. Neuronology: Opening New Pathways for High-Impact Scholarly Discovery

Neuronology represents a rare and valuable opportunity for academic universities and students to explore an uncharted scientific frontier rich with low-hanging fruits—early foundational discoveries that can quickly lead to high-impact innovations. As a nascent, pre-paradigmatic field, it offers abundant, accessible research questions that are both intellectually stimulating and practically transformative, making it an ideal domain for research scholars and Ph.D. students seeking meaningful and groundbreaking work. New scientific fields often offer far greater returns than highly mature fields, precisely because few have explored their uncharted territory—unlike established disciplines where thousands have already walked the well-trodden paths.

By engaging early, universities can position themselves as pioneering centers in this emerging discipline, attracting top talent and research funding, including from the private sector and philanthropic organizations, while students gain the unique opportunity to contribute original insights and help shape the foundational

knowledge of a field poised to revolutionize artificial intelligence, cognitive science, neural interfaces, and beyond.

We believe Neuronology will emerge as one of the most fascinating scientific fields of our time—capturing the public imagination on a scale comparable to the Big Bang Theory, Black Holes, or Space Exploration. The United States cannot afford to overlook or underinvest in such a galvanizing and transformative scientific frontier, whose potential may be beyond anything we can currently imagine.

9. The Motivation Behind This Submission

Although I have recognized from the beginning that Neuronology exceeds our present knowledge, expertise, and resources, it has nevertheless been a hobby and intellectual passion of mine for nearly a decade—pursued in the limited free time that I, my son, my daughter, and others have each month, driven by an irresistible curiosity. Just as Componentology enabled us to build complex software products as ideal Component-Based Products (CBPs) by understanding how other engineering disciplines succeed in building complex products as CBPs, I believe Neuronology can provide the essential understanding of how natural intelligence works—allowing us to replicate it artificially by identifying gaps and eliminating misconceptions in AGI research. This ongoing exploration has helped us recognize Neuronology's immense transformative potential across multiple fields.

References for Componentology and Neuronology's Grand Vision:

[1]. Componentology's Website: http://componentology.org/

[2]. A Booklet on Componentology: http://componentology.org/Fly/Booklet2.pdf

[3]. Th Grand Vision: http://neuronology.org/NeuronologyAtGrandScale.pdf