Submission for the 2025 National Artificial Intelligence R&D Strategic Plan

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Website: http://neuronology.org & http://Componentolgy.org

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Recommendation to Establish Neuronology as a Foundational Scientific Field for Applied Research in AI & AGI

The objective of this submission is to recommend the creation of a new scientific field called **Neuronology**, which can provide a rigorous scientific and theoretical foundation for applied research in Artificial Intelligence (AI), particularly Artificial General Intelligence (AGI), as well as other related fields. The potential applications of Neuronology extend far beyond computing, offering transformative possibilities in areas such as mental health, cognitive science, neural interfaces (e.g., Elon Musk's Neuralink), bio-cellular computing, and many other domains we have yet to imagine.

Neuronology for AGI refers to the study of neurons and their function in the context of creating artificial general intelligence. AGI aspires to develop intelligent machines capable of performing a wide range of tasks in a human-like manner, and achieving this goal requires a deep understanding of how the human brain processes information, learns, adapts, and performs complex computations.

Neuronology for AGI involves studying the structure and function of biological neurons, as well as how they are organized into networks that give rise to cognition, learning, memory, and reasoning. This body of knowledge can be used to develop advanced artificial neural networks—computational models designed to simulate the behaviour of biological neurons and synapses.

Researchers in the emerging field of Neuronology for AGI are focused on understanding how the brain processes information, learns from experience, and adapts to new and dynamic environments. By replicating these processes in artificial systems, researchers aim to create intelligent machines that can not only perform specialized tasks but also generalize, reason, and learn in ways comparable to human cognition.

Overall, Neuronology for AGI has the potential to profoundly transform our understanding of intelligence—both biological and artificial—and drive breakthroughs in the development of intelligent machines. As such, it represents a promising, high-impact, and foundational research area that the United States should prioritize to maintain leadership in the global AI landscape.

2. Why Neuronology Is Critical for AGI & National Leadership

Historically, every major scientific breakthrough has emerged by exposing and replacing false assumptions with rigorous, testable, and validated knowledge. The **Heliocentric paradigm**, **Quantum Theory**, and **Germ Theory** each transformed their respective fields by breaking free from prevailing misconceptions. Today, Neuronology holds the same potential to transform AI, bridging the gap between narrow AI and AGI.

Nature has already solved the problem of general intelligence in the brain's humans and other life forms. It is basic scientific common sense to focus on understanding how nature achieved this. Neuronology provides the framework to systematically study how biological neurons process, learn, adapt, and reason—insights that can be translated into artificial systems to unlock the next generation of intelligent machines.

Without such a foundational framework, attempts to build AGI risk being misdirected, inefficient, and ultimately limited in their transformative potential. Just as medicine could not advance beyond superstition without Germ Theory, AI will struggle to achieve general intelligence without the scientific paradigm that Neuronology can provide.

3. Intellectual Merit and Transformative Potential

The NSF defines intellectual merit as advancing knowledge and understanding within or across fields. Neuronology fulfills this definition by:

- Providing a rigorous, testable framework for understanding intelligence.
- Integrating insights from neuroscience, cognitive science, computer science, and software engineering.
- Enabling breakthroughs not only in AI, but also in mental health, bio-computing, neural interfaces, and more.

Our two decades of pioneering research in http://Componentology.org taught us that the best way to expose misconceptions and refine understanding is through the creation of frameworks, tools, and technologies that allow concepts to be objectively tested, validated, and if necessary, falsified. Neuronology offers the opportunity to establish such a framework for AGI research, preventing decades of wasted effort and unlocking paradigm-shifting innovations across disciplines.

By providing the vital scientific foundation for applied research in software engineering, Componentology enabled us to invent the tools and frameworks necessary to effectively address the infamous software crisis. Drawing on two decades of experience in creating and applying scientific knowledge to solve complex, previously unsolved software challenges, we recognized years ago that Neuronology represents the essential and currently missing scientific and theoretical foundation needed to guide applied research in AGI.

4. Research Challenges and Strategic Questions

Neuronology will address several high-priority research challenges:

- **Fundamental mechanisms:** What are the basic principles by which biological neurons encode, process, and transmit information?
- **Formal models:** How can these biological principles be abstracted into formal, computable models?
- **Continual learning:** What architectures can support lifelong learning, self-organization, and cross-task adaptation?
- **Beyond deep learning:** How can we go beyond current artificial neural networks to develop systems with genuine reasoning, abstraction, and generalization capabilities?
- **Separation of concerns:** How do we distinguish between the scientific search for truth and the engineering pursuit of practical applications, ensuring that applied research is grounded in validated theory?

Importantly, **Neuronology** promises numerous **low-hanging fruits**—early-stage discoveries that can deliver tangible returns within a few years, giving the United States a critical competitive advantage and setting up barriers to entry for international rivals.

Attachments:

[1]. **Why It Is Essential to Create and Utilize Neuronology**

[2]. **Potential Unjustifiable Opposition to Neuronology**

[3]. **A Fifteen Minute Google NotebookLM's Podcast on Neuronology**

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