

## Peer Review

# Review of: "The Evolving Landscape of Neuroscience"

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This is a remarkably deep and informative overview of the scope, direction, and focus of neuroscience in the first quarter of the 21<sup>st</sup> century. It combines the power of computing with the analytical potential of artificial intelligence (AI) and the compositional facility of large language models (LLMs) to produce a summary of the focus of and trends within contemporary neuroscience. If anyone questions the utility of AI and LLMs to analyze and extrapolate useful insights and information from huge datasets, this paper should lay those doubts to rest.

For today's practicing neuroscientists, many of the author's conclusions will come as no surprise. For example, the time course of citation frequencies, the identity of the most influential journals in the field, the ratio of empirical research studies to review publications, and the tendency to focus on micro theoretical perspectives are well-recognized patterns. But never have they been documented with such precision, based on such a large body of data.

On the other hand, some observations are in fact enlightening, if not surprising. The large number of publications on microglia activation in response to CNS injury (cluster 3) and neural mechanisms of speech processing (cluster 16) compared to the much lower number of publications on cannabinoid-mediated modulation of pain and nociception (cluster 170) and neurological and neuropsychiatric manifestations of COVID-19 (cluster 171) will probably be unexpected to most readers. The relative decline in basic as opposed to applied research is a widely held impression within the neuroscientific community, so having it confirmed on this scale is a validation of that impression.

The author's Discussion is an astute and valuable synthesis of the big picture that emerges from his study. His point about the limitations that exist across spatio-temporal scales in neuroscience is particularly useful. I totally concur with his statement that, "Processes unfolding at certain scales may simply not be relevant for understanding processes at other scales as each constitutes a self-contained

system whose governing principles, despite emerging from smaller scales, nevertheless operate independently.” Perhaps this helps explain the difficulty of bridging the gap between phenomena at the level of cells and circuits with cognitive processes and consciousness.

My enthusiasm for this paper is tempered only by two concerns, both of which are observations rather than criticisms. The first is the virtually unintelligible methodology. Though well described, the programs, algorithms, terminology, processes, and strategies that obviously are necessary tools in the employment of AI and LLMs will be a mystery to readers of this paper not well versed in their usage. This is particularly the case with specifying how the research domain clusters were derived. Even the first paragraph under “Neuroscientific Research Domain Clusters” in the Results section, where a general explanation of the aims and strategy for defining the domains would be expected, contains terms like “cosine similarity,” “centroid,” and “text embeddings” that will not be understood by the majority of readers who have a limited knowledge of AI methodology; so for them, this paragraph will be a lost opportunity. This detail is obviously important and relevant to the AI and LLM strategies at the heart of this work, but a plainer language summary of how the research domain clusters were created and constrained would enlarge the number of readers who could appreciate the work.

A pertinent question, for instance, is: Where did the key words in Supplementary Table 01 come from? Perhaps that information resides in the methodological description somewhere, but I couldn’t pick it out. That being the case, I wondered about the absence of certain terms that surprised me. “Neuroactive” and “cell assembly,” for example, have been prominent in neuroscience historically. “Gender” and “glycolipid” are broadly encompassing terms still in wide use. “Phenomenology” is a major theoretical framework that frequently appears in publications focusing on consciousness and cognition.

My second observation starts with a compliment. The paper is very well written. Aside from the author’s natural talent as a writer, I assume that the high quality of the composition was aided by LLM-based writing assistance from OpenAI, as stated by the author. He provides the specific instructions given to ensure factual accuracy, clarity, and conciseness, devoid of “hallucinations” and compatible with current academic writing in neuroscience. I can detect no evidence that those guidelines were not followed by the LLM-assisted composition. Since the author also carefully edited the final manuscript, I find this to be an acceptable and laudable use of AI as a valid tool in the overall publication process.

While admitting that I lack the expertise to judge the appropriateness of the author’s methodology and have no way of knowing for certain that LLM-assisted composition did not alter the author’s original

intent in any way, he affirms that it did not. On those assumptions, I take this manuscript on its face to be excellent and worthy of the highest rating.

## **Declarations**

**Potential competing interests:** No potential competing interests to declare.