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Dear Nature Electronics Editors,

Thank you very much for considering this perspective article for publication in Nature Electronics. Neuromorphic computing and artificial intelligence are important subjects at the present moment, and it is necessary for the community to explore multiple paths toward high-performance neural systems. While most efforts intend to adapt existing hardware to perform this new type of computing, at NIST we are taking a different approach. We are trying to think from first principles about which physical mechanisms are most capable of leading to large-scale neural systems, and we are designing our hardware with scalable fabrication in mind at every step. This paper summarizes our thinking toward this end. The salient principles of neuroscience and very-large-scale integration are summarized so that non-specialists can follow the reasoning. Some readers may not agree with the decisions we have made or may think of approaches other than superconducting electronics to achieve comparable functionality. Yet we think the hardware we present here—from devices to systems—will be thought provoking and inspire others to consider the limits of what can be accomplished with new approaches to neural computing. Thank you again for this opportunity.

Best regards,
Jeff Shainline