

NEWS | JUNE 22 2026

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Scilight 2026, 261101 (2026)

<https://doi.org/10.1063/10.0044179>



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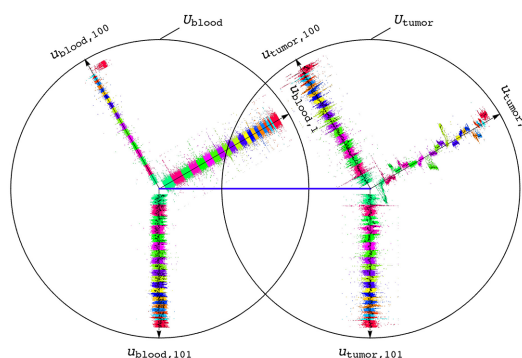
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22 June 2026

A quantum mechanics approach to artificial intelligence can improve cancer outcomes

Mara Johnson-Groh

Using principles of superposition and entanglement, researchers develop a framework to tailor a patient's cancer treatment to their entire molecular background.



For a child diagnosed with neuroblastoma, the path to treatment isn't simple. Some types of neuroblastoma resolve on their own, while others require aggressive treatments. Researchers have tried matching treatments to patients based on one-gene mutations but with limited success, as patients' outcomes depend on their entire molecular background containing millions of features, such as DNA and RNA from tissues and blood. Current artificial intelligence and machine learning (AI/ML) approaches struggle to derive predictors from the 20-100 patient samples of a clinical trial because they require massive amounts of training data.

But by using the mathematics of quantum mechanics, Alter et al. developed an AI/ML technique that can improve treatment selections and drug success rates. The technique features a suite of algorithms, called multitensor comparative spectral decompositions, which were built on the quantum mechanical concepts of entanglement and superposition. They separate the molecular data from a patient into outcome components represented by patterns entangled across the feature types, similarly to how a prism splits white light into its color components.

The authors demonstrated their technique with an analysis of open-source data of neuroblastoma cases. Their algorithms discovered two new predictors, found in the tumor and blood genomes and tumor transcriptome, of patients' life expectancy in response to treatment that all other methods missed. The two predictors consistently outperformed standard biomarkers across tumor and blood DNA and tumor RNA.

"Neural network models are black boxes, but our predictors are interpretable; they point to disease mechanisms and suggest genes to target to sensitize tumors to treatment," said author Orly Alter. "Our team recently experimentally validated our predictions of adult glioblastoma patient outcome and drug targets in clinical trials and CRISPR-Cas9 studies."

Source: "Quantum mechanics-based multitensor AI/ML uniquely able to discover, validate, and interpret predictors from small-cohort noisy high-dimensional multiomic data," by Orly Alter, Elizabeth Newman, Sri Priya Ponnappalli, and Jessica W. Tsai, *APL Quantum* (2026). The article can be accessed at <https://doi.org/10.1063/5.0305656>.

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