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## Lab Partnership Develops Programmable Nanoprocessor

By [Radhika Jain](#), CRIMSON STAFF WRITER

Second graders completing their math worksheets are not the only little ones doing basic arithmetic anymore: Researchers at Harvard and the MITRE Corporation have recently collaborated to develop the world's first programmable nanoprocessor.

Researchers at the lab of Chemistry Professor Charles M. Lieber had been working on the project with engineers at MITRE, a not-for-profit organization funded by the U.S. government, for more than two years. The team succeeded in assembling tiny processors capable of performing basic arithmetic operations.

Their paper describing the revolutionary computer system, was published yesterday in the journal Nature.

"This was a very challenging project. We were building something that had never been built before using techniques that had never been used before," said James F. Klemic, nanotechnology laboratory director at MITRE.

Assembling individual nanoscale building blocks into a system of "collaborative" behavior was difficult, according to Hao Yan, first author of the study and a postdoctoral researcher in Lieber's lab.

In manufacturing the wires that make up the processing system, Lieber's lab opted to chemically synthesize the structures, a "bottom-up" approach which represents a departure from the conventional method of crafting wires from blocks of silicon.

The researchers were able to program the nanowires by coating them with a metal oxide. Unlike circuits in normal electronics, which can only perform one function, these nanocircuits are multifunctional, according to co-author SungWoo Nam.

Klemic said the potential applications for this technology are immense.

"Right now controller chips are ... heavy and they're big. There are plenty of applications where you would want to have smart devices that are smaller than that," he said, citing surgery monitors and drug delivery devices as examples.

Shamik Das, the lead engineer in MITRE's Nanosystems Group and chief architect of the nanoprocessor, said the opportunity to collaborate with Harvard was "productive and fruitful."

The researchers emphasized that there was the potential for future inventions.

"The next big thing is to see whether you can take multiple nanowires, connect them together and see if they can perform more complicated processes," Yan said.

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