

Media Release

THURSDAY, 12 JULY 2018



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The future of electronics is chemical

We can't cram any more processing power into silicon-based computer chips.

But a paper published in *Nature* overnight reveals how we can make electronic devices 10 times smaller, and use molecules to build electronic circuits instead.

We're reaching the limits of what we can do with conventional silicon semiconductors. In order for electronic components to continue getting smaller we need a new approach.

Molecular electronics, which aims to use molecules to build electronic devices, could be the answer.

But until now, scientists haven't been able to make a stable device platform for these molecules to sit inside which could reliably connect with the molecules, exploit their ability to respond to a current, and be easily mass-produced.

An international team of researchers, including Macquarie University's Associate Professor Koushik Venkatesan, have developed a proof of concept device which they say addresses all these issues.

Their research was published overnight in *Nature*.

The team exploited the fact that metallic nanoparticles can provide reliable electrical contacts to individual molecules, allowing them to transport charge through a circuit.

Their next goal will be to test the platform with different molecules that have different functions to see if they can make it work.

If successful, their technique could lead to molecular compounds being integrated into solid-state devices that could be scaled down to the size of a single molecule.

"Imagine a miniaturised transistor made up of several single molecules," says Koushik.

"That's the promise of molecular electronics—devices that are smaller, faster, have more memory and are cheaper to make."

Koushik is confident their research will open up the bottleneck for this molecular-based technology to move forward.

"Molecular electronics hasn't previously lived up to expectations, but we've seen a renaissance of the field in the last five to six years," he says.

"The device platform is the missing link. We hope work like ours will accelerate this type of technology.

"The electronic building blocks of the future will be molecules."

"This fundamental research is extremely exciting as it points the way to practically 'wiring molecules' by exploiting the fact that Koushik and his colleagues have made a metallic nanoparticle provide a reliable electrical contact to individual molecules," says Professor Alison Rodger, Head of the Department of Molecular Sciences at Macquarie University.

"As a molecular scientist it illustrates to me the importance of understanding the design and function of molecules for the future realisation of a molecular electronics technology.

"It is amazing to think that this work leads the way to true molecular-sized electronic circuits."

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The paper was co-authored by researchers from Macquarie University, IBM Research – Zurich, the University of Basel, the University of Zurich, Karlsruhe Institute of Technology and Sun Yat-Sen University.

Puebla-Hellmann G, Venkatesan K, Mayor M & Lörtscher E. [Metallic nanoparticle contacts for high-yield, ambient-stable molecular-monolayer devices](#). *Nature*, July 2018.

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