

## DNA nanorobots deliver medicine inside cockroaches, act like a computer

DNA is molecule of many talents — and kitting out cockroaches with the processing power of a Commodore 64 is now one of them.

Microscopic robots made from DNA molecules have been used to deliver drugs inside living cockroaches—and could be poised to do much more. According to [Sarah Spickernell at New Scientist](#):

It's a computer – inside a cockroach. Nano-sized entities made of DNA that are able to perform the same kind of logic operations as a silicon-based computer have been introduced into a living animal.

These nanocomputers have the ability to be used as part of specialized cancer treatment programs where DNA molecules would move around the body, delivering drug payloads at the precise locations they're needed.

Spickernell explains:

When it meets a certain kind of protein, DNA unravels into two complementary strands. By creating particular sequences, the strands can be made to unravel on contact with specific molecules – say, those on a diseased cell. When the molecule unravels, out drops the package wrapped inside.

In this case, the package would be medicine. The DNA nanobots move around in the insect's body without interfering with its normal genetic processes, instead responding only to their targets. With enough of the robots present with the right combination of programming, they can could carry out complicated processes like a tiny, distributed computer.

The nanocomputers may be comprised of DNA, but they're not part of the cockroaches' genetic code. DNA is a versatile molecule, and in this case it's the physical structure of DNA that makes it useful. DNA computers are called "[origami robots](#)" because they use the folding and unfolding of the DNA molecule to do their work.

This is the latest in a string of inventive uses for the DNA molecule outside of its usual biological function. It's has also been used for data storage, amplification of chemical signals, and less sophisticated origami robots.

The team behind this research, led by bioengineer Daniel Levner at the Wyss Institute, Harvard and his colleagues at Bar Ilan University in Israel, says they've crossed a threshold. "The higher the number of robots present, the more complex the decisions and actions that can be achieved. If you reach a certain threshold of capability, you can perform any kind of computation. In this case, we have gone past that threshold," co-author Ido Bachelet told Spickernell.

Spickernell writes that “it should be possible to scale up the computing power in the cockroach to that of an 8-bit computer, equivalent to a Commodore 64 or Atari 800 from the 1980s.”

The major obstacle to taking this technology into humans—and any non-insects in general—is the immune system. It will recognize these DNA molecules as foreign bodies and try to expel them. That’s not discouraging to the researchers, apparently:

Bachelet is confident that the team can enhance the robots’ stability so that they can survive in mammals. “There is no reason why preliminary trials on humans can’t start within five years,” he says.

**Read Sarah Spickernell’s article at New Scientist: “[DNA nanobots deliver drugs in living cockroaches](#)”**

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**Additional Resources:**

- “[Smallest DNA origami nanorobot yet has a switchable flap](#),” Michael Berger | Nanowerk
- “[Fighting Cancer with Nanomedicine](#),” Dean Ho | The Scientist
- “[How IBM is Using Nanotechnology to Tackle MRSA and HIV](#),” Adam Bluestein | Fast Company