Miniature airborne microchips touted as breakthrough for disease and pollution monitoring

ABC Science

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The researchers think scores of the micro-flyers could be dropped at once to gather data.

(Supplied: Northwestern University)

A new microchip roughly the size of a grain of sand that has the potential to glide across great distances is being touted as a breakthrough for aerial surveillance.

Key points:

- The devices are about the size of a grain of sand and can transmit wirelessly
- Remote sensing technology was originally developed for warfare
- The researchers hope the technology can be used to help monitor disease spread

Collaborating scientists from institutions including Northwestern University in the United States and Soongsil University in Korea have created what they believe are the world's smallest ever "human-made flying structures", which can be fitted with microchips and sensors and have the capacity to transmit data remotely.

The microchips can be dropped from the sky and potentially used to monitor environmental impacts and the spread of disease.

The researchers, who published their findings today in the journal Nature, developed the miniature flyers after studying the aerodynamics of wind-dispersed seeds from trees like the maple, dandelion and jacaranda.

Using computer simulations, the team was able to establish which shape would fall the slowest and disperse the farthest while maintaining a controlled descent.

And they think they've achieved a result that rivals anything in nature, according to Northwestern University's John Rogers, who led the development of the devices.

"We think we've beaten biology, in a sense," Professor Rogers told the journal.

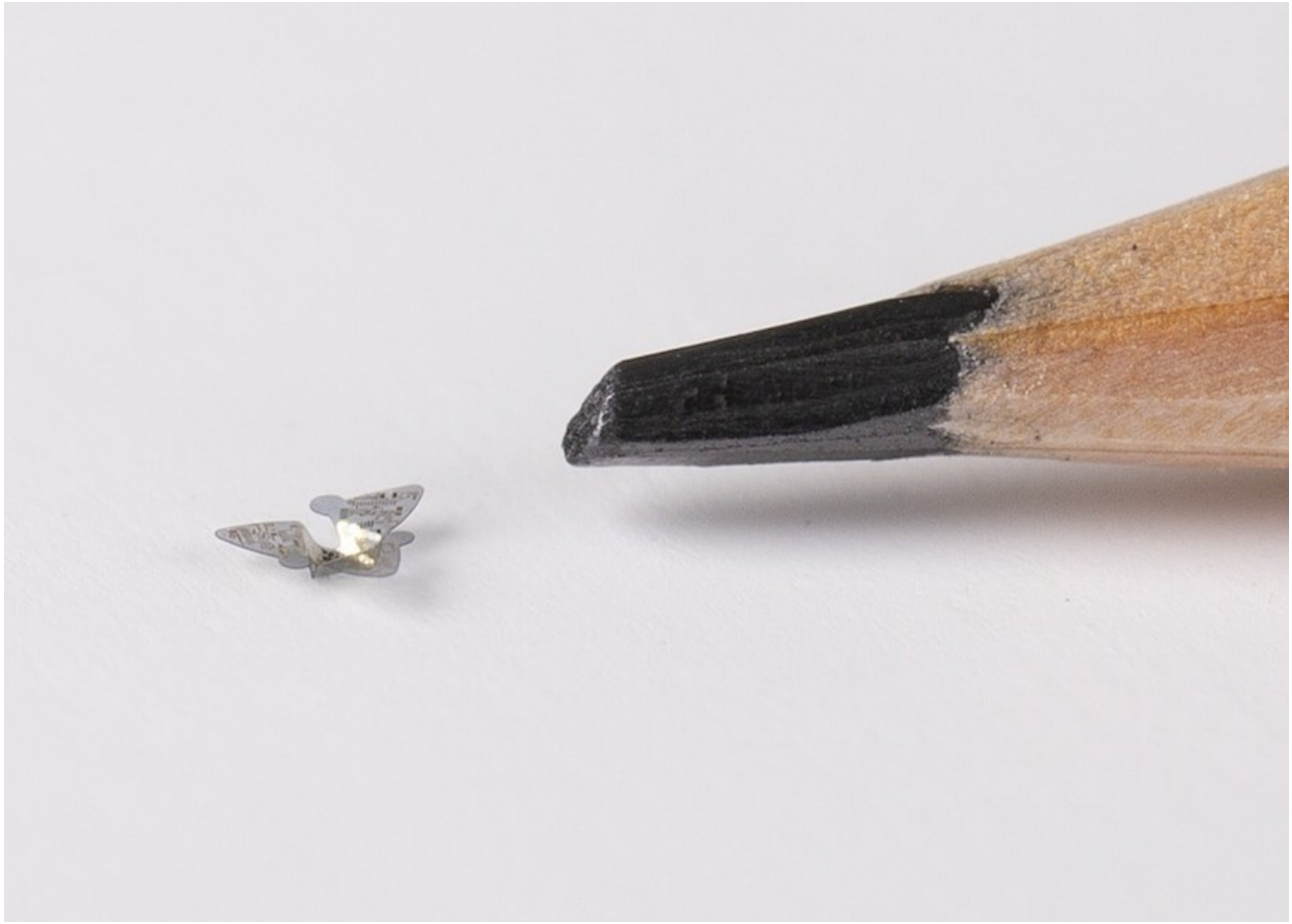
> "We've been able to build structures that fall in a more stable trajectory at slower terminal velocities than equivalent seeds."

However, he told the ABC that his team had an unfair advantage.

"Nature is optimising designs in a space [with many competing needs] and with severe constraints associated with growth conditions, energy expenditure, materials, etc," Professor Rogers said.

"We are not."

Thousands could be deployed at a time



The gliding microchips have potential for use in air pollution and airborne disease monitoring. *(Supplied: Northwestern University)*

The micro-flyers the scientists created most resemble the star-shaped seed of the tristellateia vine, which have small blades that allow them to rotate and disperse far from the parent plant.

Once they established and made the most efficient design, the micro-flyers were fitted with tiny sensors, a solar power source and antennae.

The researchers have so far trialled the devices fitted with pH monitors and airborne particulate sensors; however, they see the application of the miniature flyers as potentially very wide ranging.

Part of the advantage in developing such a small device is that it keeps costs down, Professor Rogers said.

"Cost is an important consideration.

"The closest existing technology is in RFDI [Radio Frequency Identification] tags, which these days can be obtained for a few cents per tag."

Given their very small scale and relatively low cost, the idea would be to deploy thousands of the devices from the sky at a time, to gather data over a particular area.

"Our goal was to add winged flight to small-scale electronic systems, with the idea that these capabilities would allow us to distribute highly functional, miniaturised electronic devices to sense

the environment for contamination monitoring, population surveillance, or disease tracking," Professor Rogers said.

Eco flyer*(Gfycat)*

But releasing hundreds or thousands of the devices could create its own environmental issues.

So the team has also been developing technology to allow the micro-flyers to degrade after deployment.

"We have the technology for environmentally degradable electronics," Professor Rogers said.

"We have been developing the materials, devices and manufacturing schemes for more than 10 years."

Remote sensing originally developed for warfare

The biggest leap forward that this development represents is the capacity for dispersal, according to Nam-Trung Nguyen, who is the director of Griffith University's Queensland Micro and Nanotechnology Centre.

Professor Nguyen's team has developed similar stationary devices that can be stuck to the skin or implanted into the body to monitor a patient's health.

His team sometimes works with Professor Rogers, but he was not involved in this study.

While the technology is much smaller today, Professor Nguyen said remote sensing was initially developed by the US military for use during the Vietnam War era.

"Mainly the military was interested in the technology for surveillance," he said.

Of course larger flying devices like drones can already capture video and images, and Professor Nguyen said the micro-flyers could probably also be fitted with the technology to stream footage.

But as with any advances in technology, he said there was a need to consider the potential for misuse.

"If you look back to the '60s and '70s, the US used it in warfare to collect information. The police could use the same thing [today]," he said.

> "Of course privacy is an issue. Whoever owns it can collect information about anybody."

Professor Rogers said the next step in their research was to give the micro-flyers the capacity for powered flight.

"The other thing we're thinking about is how to add active flight capabilities," he said.

"So not something that just falls like a seed, but something that could fly away, like a housefly."

Source