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# British scientists use man-made DNA speck to store 739kB of digital data

British scientists put Shakespeare's sonnets onto barely visible speck and say all the world's digital information could be similarly preserved

Agence France-Press in Paris

Friday, 25 January, 2013, 12:00am



Binary code was converted into the four-letter alphabet of DNA.

Scientists in Britain have announced a breakthrough in the quest to turn DNA into a revolutionary form of data storage that could fit the world's entire three billion terabytes of stored data into the palm of your hand.

They said a speck of man-made DNA could hold mountains of data that could be freeze-dried, shipped and stored, potentially for thousands of years. The contents are "read" by sequencing the DNA - as is routinely done today, in genetic fingerprinting and so on - and turning it back into computer code.

"We already know that DNA is a robust way to store information because we can extract it from bones of woolly mammoths, which date back tens of thousands of years, and make sense of it," said Nick Goldman of the European Bioinformatics Institute in Cambridge, a co-author of the study published in the journal *Nature* on Wednesday.

The study reported that the institute's team had stored all 154 Shakespeare sonnets, a photo, a PDF of a scientific paper, and a 26-second sound clip from US civil rights leader Martin Luther King Jr's "I Have a Dream" speech in a barely visible bit of DNA in a test tube.

"We downloaded the files from the web and used them to synthesise hundreds of thousands of pieces of DNA. The result looks like a tiny piece of dust," said Emily Leprout of Agilent, a biotech company that took the digital data and used it to synthesise molecules of DNA in a laboratory in the United States.

# 739kB

The amount of data that researchers were able to store on a speck of DNA in their test

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## Weapons grade (/magazines/post-magazine/article/1129323/weapons-grade)

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Agilent then mailed the sample across the Atlantic to the EBI, where the researchers soaked it in water to reconstitute it and used standard sequencing machines to unravel the code. They recovered and read the files with 100 per cent accuracy. "It's also incredibly small, dense and does not need any power for storage, so shipping and keeping it is easy," Goldman added.

The process involved converting the ones and zeroes of digital information into the four-letter alphabet of DNA code. That code was used to create stands of synthetic DNA. Then machines "read" the DNA molecules and recovered the encoded information perfectly. The reading process took two weeks, but technological advances are driving that time down, said co-author Ewan Birney of the institute.

The data stored in the test amounted to only 739 kilobytes, but the technique could be scaled up to store the three zettabytes, or 3,000 billion billion bytes, of stored data estimated to exist on earth, and the only limitation to wide implementation is the high cost of synthesising DNA, the researchers said. The world's data would theoretically fit in one hand and could be stored safely for many centuries, they said.

"It scales remarkably well; the coding scheme would work to a zettabyte level," Birney said.

Goldman added: "As the price comes down, it could work on a big scale for large corporations, governments, and in the future for individuals."

Don't throw out your hard drives just yet, though. DNA might be useful for keeping huge amounts of information for a long time, but retrieval would likely need to be infrequent. On the other hand, storing the DNA would be simple, the researchers said: Just put it in a cold, dry and dark place and leave it alone.

The technology might work in the near term for large archives that have to be kept safe for centuries, like national historical records or huge library holdings, said Goldman. Maybe in a decade, it could become feasible for consumers to store information they want to have around in 50 years, like wedding photos.

The work does not entail using any living DNA, nor does it seek to create any life form. "We have absolutely no intention of messing with life," said Goldman.

**Additional reporting by Bloomberg, Associated Press**

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