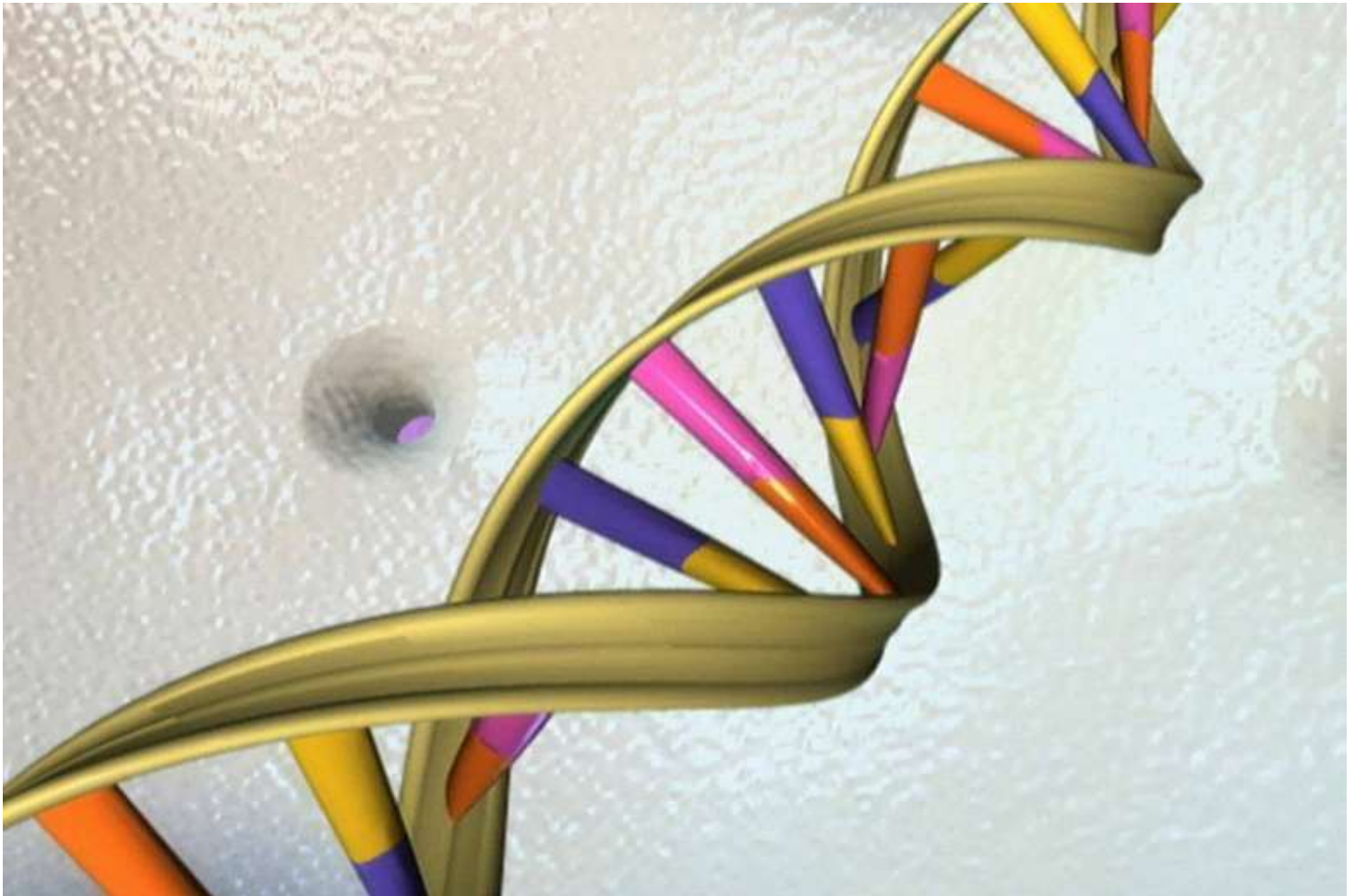


No space for data? Store it in DNA



Twist Bioscience CEO Emily Leproust believes the solution to storing exponential amount of digital data is to store it on DNA. PHOTO: REUTERS

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Creating 'storage files' in genetic material among advances in synthetic biology field



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With the amount of digital data growing exponentially worldwide, data storage is posing a huge headache for consumers, organisations and businesses worldwide looking to store anything from medical information to video footage.

Dr Emily Leproust believes she has a solution - by storing digital data on DNA.

She is the chief executive of Twist Bioscience, a United States biotechnology company that creates made-to-order DNA for researchers and companies that work in areas such as personalised medicine and genetic engineering.

In the area of data storage, the company utilises a silicon-based writing platform to encode digital data into DNA efficiently.

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DNA is seen as a viable alternative because it can store information millions of times more compactly than current technologies. And if kept in the right conditions, DNA can also preserve information for centuries.

The amount of data the world is juggling is mind-boggling.

According to Northeastern University in the US, this amounted to 4.4 zettabytes in 2013, and is set to climb to 44 zettabytes by 2020 (one zettabyte is one trillion GB).

ROUTINE PRODUCT SOON

Using DNA as a data storage solution will soon become a routine product.

DR EMILY LEPROUST, chief executive of Twist Bioscience.

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ensure that synthetic biology is conducted in an open and ethical manner - to provide 10,000 genes to the synthetic biology community.

BioBricks will pay for the synthesis of genes and manage a no-cost, open online forum that will allow researchers worldwide to offer suggestions on which genes should be built.

CHANGING THE WORLD

Through the industrialisation of synthetic biology, we hope to impact the world in a big way.

MR RANDAL KIRK, chief executive of Intrexon, a US-based company that creates biologically based products and processes.

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storage research.

Twist Bioscience says that to date, it has raised a total of US\$191 million.

The company leverages synthetic biology - the application of engineering principles to the fundamental components of biology.

To write data to DNA, researchers translate the binary code of a file into the bases that form DNA's building blocks, assigning different base pairs to represent ones and zeroes by changing the encoding from zeroes and ones to zeroes, ones, twos and threes, or quaternary encoding.

Then, custom strings of DNA based on the resulting patterns are created.

To retrieve the data, researchers would simply use the same DNA sequencing process that scientists use to decode genomes from plants or animals, then translate them back into binary code.

Dr Leproust was one of the 100 industry experts speaking at the Seventh International Meeting on Synthetic Biology, at the National University of Singapore's University Cultural Centre, last week.

The event was co-organised by the NUS' Synthetic Biology for Clinical and Technological Innovation (SynCTI), the BioBricks Foundation and SynBioBeta, an international community of entrepreneurs, investors, policymakers and enthusiasts devoted to the responsible growth of the synthetic biology field.

The four-day conference saw around 900 participants from more than 40 countries gather to share and learn about the field.

Synthetic biology promises to revolutionise the world, with the potential to create clean biofuels, self-fertilising crops and new medical treatments.

Recognising its potential, Singapore's National Research Foundation (NRF) has invested \$34 million in synthetic biology-related R&D, in the form of research project grants to universities and research institutes, under the Biological Design Tools and Applications grant call and the NRF's Competitive Research Programme.

The field's diverse range of applications was reflected in the conference's programme line-up, which also featured Mr Randal Kirk, the chief executive of Intrexon, a US-based company that creates biologically based products and processes.

"Through the industrialisation of synthetic biology, we hope to impact the world in a big way," Mr Kirk said.

This makes storing it big business. According to Forbes magazine, the International Data Corp believes that worldwide revenues for big data and business analytics will grow from US\$130.1 billion (\$180 billion) last year to more than US\$203 billion in 2020.

"Using DNA as a data storage solution will soon become a routine product," Dr Leproust said, although she cautioned that challenges remain, including making the technology affordable and accessible.

On Thursday last week, Twist Bioscience announced a partnership with BioBricks Foundation - a public benefit organisation in the US working to

Dr Leproust also pointed out that just two months ago, tech giant Microsoft announced the purchase of 10 million strands of DNA from her company for expanded digital

His company is behind creating apples that do not brown, producing salmon that grows twice as fast, and cloning animals.

The firm also hopes to slow down the spread of mosquito-borne diseases such as Zika and dengue by genetically modifying male mosquitoes to pass down a gene that kills their offspring.

In Singapore, SynCTI's ongoing research includes the engineering of microbes for conversion of renewable and economical resources - such as sugar and food waste - into valuable chemicals.

Said one conference participant, Mr Jonathan Lai, 22, an NUS biomedical engineering student: "Attending this conference and listening to the top researchers have given me good exposure to the developments in the synthetic biology industry."