Convention on the Rights of the Child stored in DNA

November 12, 2019

OSLO, Norway, SAN FRANCISCO, Calif., CAMBRIDGE, UK and PESSAC, France – November 12, 2019: To celebrate the 30-year anniversary of the United Nations Convention on the Rights of the Child, UNICEF has found a way to ensure that this important document is stored for all foreseeable future.

The UN Convention on the Rights of the Child (CRC) was unanimously adopted by the General Assembly of the United Nations on November 20th, 1989. This year, the document will be stored in synthetic DNA.

The capsule containing the DNA will be kept in one of the safest places in the world, in the permafrost at the Arctic World Archive in Svalbard, Norway.

First document to be stored officially in DNA

"The Convention on the Rights of the Child is one of the world's most important documents. It protects our children and their rights and will now be a part of our organizational DNA. The Children's Rights Convention is the first document to be stored officially in DNA," says UNICEF Norway's Executive Director Camilla Viken.

Why DNA storage?

Most documents, photos, videos and other data are stored digitally, including the CRC. The problem with digital storage is that the technology quickly becomes outdated; floppy disks, CDs and even USB-sticks are examples of this.

Today, we store most of our digital data in "the cloud". Despite the name, this means that we rely on physical hard drives vulnerable to power outages, hacking, war and natural disasters.

Scientists have developed several methods that make it possible to store information in nature's oldest storing device: DNA. DNA is a molecule which carries genetic information in all living creatures, and therefore works as nature's own hard drive. In this case, synthetic DNA has been used to store digital information.

"Today it can actually be easier to retrieve information from prehistoric remains than from an old mobile phone. Storing digital data in synthetic DNA is like coding on ordinary computers; it's just another language. It's a bit like translating from one language to another," says Nick Goldman, Senior Scientist at EMBL's European Bioinformatics Institute in Cambridge, UK.

Goldman is one of the scientists who first developed methods for storing large amounts of data in DNA and is responsible for encoding the Convention into a DNA-based format. The encoded document has then been synthesized and sequenced by Twist Bioscience (Nasdaq: TWST) in San Francisco, US:

"This project is an illustrative example of the way we are able to bring together innovative technologies based on biology to protect and benefit children worldwide and we are honored to be a part of this effort," says Emily M. Leproust, CEO and Co-Founder of Twist Bioscience, and co-author of one of the first publications on DNA data storage.

The finished synthetic DNA has then been put into small pill-shaped stainless-steel capsules by Imagene SA in Pessac, France:

"We are honored to contribute to this project with our unique preservation technology, enabling the Convention on the Rights of the Child to remain recoverable and readable for centuries and even millennia to come," says Sophie Tuffet, CEO and Co-Founder of Imagene SA, and co-author of one of the first publications on long term room temperature DNA storage.

World Children's Day 2019

The Convention on the Rights of the Child is being stored in DNA by UNICEF to accentuate its importance and ensure that its content is available for generations to come:

"There are children all over the world who are in need of the protection this document provides. We encourage everyone to become familiar with the convention, both today and in the future," says Viken.

On World Children's Day, November 20 th, the Convention on the Rights of the Child will be brought to Svalbard, Norway, for safe keeping.

FACTS AND EVENTS:

How to Store Digital Data in DNA:
To encode the document into archival storage copies in DNA, first, the digital files were converted from the binary code using 0s and 1s of digital data into sequences of A, C, T and G by EMBL-EBI. Twist Bioscience then synthesized the DNA in short segments in the sequence order provided. The

short DNA segments each contain about 20 bytes of data as well as a sequence number to indicate their place within the overall sequence. This is the process of storage. To ensure that the file is stored accurately, Twist reads the sequence back to ensure 100 percent accuracy. Finally, to store the document for the future, Imagene SA placed copies of the document encoded in DNA into DNAshells, small stainless-steel capsules, laser sealed under inert atmosphere, for up to thousands of years preservation at room temperature.

About UNICEF and the UN Convention on the Rights of the Child:

• UNICEF is the world's largest aid organization for children and works to create lasting change and strengthen rights - for every child.

• The UN Convention on the Rights of the Child was unanimously adopted by world leaders at the UN General Assembly on November 20, 1989.

• The four main principles of the Children's Rights Convention are:

o non-discrimination

o the best interests of the child

o the right to survival and development

o the right of the child to speak and be heard

• The UN Convention on the Rights of the Child celebrates 30 years on World Children's Day, November 20, 2019.

• UNICEF stores the document in synthetic DNA.

• On November 20th, the DNA sample will be stored in suitable conditions under the permafrost at the Arctic World Archive in Svalbard.

About EMBL's European Bioinformatics Institute (EMBL-EBI)

The European Bioinformatics Institute (EMBL-EBI) is a global leader in the storage, analysis and dissemination of large biological datasets. We help scientists realise the potential of 'big data' by enhancing their ability to exploit complex information to make discoveries that benefit humankind.

EMBL-EBI is at the forefront of computational biology research, with work spanning sequence analysis methods, multi-dimensional statistical analysis and data-driven biological discovery, from plant biology to mammalian development and disease.

We are part of EMBL and are located on the Wellcome Genome Campus, one of the world's largest concentrations of scientific and technical expertise in genomics.

Website: www.ebi.ac.uk

About Twist Bioscience Corporation

Twist Bioscience is a leading and rapidly growing synthetic biology company that has developed a disruptive DNA synthesis platform to industrialize the engineering of biology. The core of the platform is a proprietary technology that pioneers a new method of manufacturing synthetic DNA by "writing" DNA on a silicon chip. Twist is leveraging its unique technology to manufacture a broad range of synthetic DNA-based products, including synthetic genes, tools for next-generation sequencing (NGS) preparation, and antibody libraries for drug discovery and development. Twist is also pursuing longer-term opportunities in digital data storage in DNA and biologics drug discovery. Twist makes products for use across many industries including healthcare, industrial chemicals, agriculture and academic research. The company has been involved in many DNA data storage projects including work with the Montreux Jazz Festival, the Arch Mission, the Time Machine and more.

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About Imagene's DNAshell® technology

DNAshell® technology enables the confinement of desiccated DNA molecules under an anoxic and anhydrous inert atmosphere inside airtight, laser-sealed, laser-engraved, stainless steel capsules. In the absence of the alteration factors: water, oxygen, and light, natural or synthetic DNA can be stored at room temperature for a nearly limitless period of time. DNAshell® is a robust, standalone storage platform enabling the safe and stable storage and distribution of material with zero ongoing energy costs. The high DNA storage capacity of these capsules allows the storage of enormous amounts of data in a small volume. Imagene's DNAshell® technology has been successfully extended to the preservation of RNA, blood, and microorganisms for applications in biobanking and molecular diagnostics. Imagene is both a service provider and instrumentation supplier.

For more information, please email contact@imagene.eu or visit www.imagene.eu

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new information, future events or otherwise.

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UNICEF is the world's largest aid organization for children. In over 190 countries and territories we work for children to survive, grow up and develop to their full potential - protected from violence and abuse. We believe that the future belongs to those with the greatest belief that it can be changed, which is why we are also working to change the structure of communities where the best interests of children are not safeguarded. UNICEF Norway is working nationally to achieve UNICEF's global goals.