

Two items of music anthology now stored for eternity in DNA

September 29 2017, by Emmanuel Barraud



A few drops of DNA would be enough to store all the world's music! Credit: EPFL / Alain Herzog

Thanks to an innovative technology for encoding data in DNA strands, two items of world heritage – songs recorded at the Montreux Jazz Festival and digitized by EPFL – have been safeguarded for eternity. This marks the first time that cultural artifacts granted UNESCO heritage status have been saved in such a manner, ensuring they are

preserved for thousands of years. The method was developed by US company Twist Bioscience and is being unveiled today in a demonstrator created at the EPFL+ECAL Lab.

"Tutu" by Miles Davis and "Smoke on the Water" by Deep Purple have already made their mark on music history. Now they have entered the annals of science, for eternity. Recordings of these two legendary songs were digitized by the Ecole Polytechnique Fédérale de Lausanne (EPFL) as part of the Montreux Jazz Digital Project, and they are the first to be stored in the form of a DNA sequence that can be subsequently decoded and listened to without any reduction in quality.

This feat was achieved by US company Twist Bioscience working in association with Microsoft Research and the University of Washington. The pioneering technology is actually based on a mechanism that has been at work on Earth for billions of years: storing information in the form of DNA strands. This fundamental process is what has allowed all living species, plants and animals alike, to live on from generation to generation.

The entire world wide web in a shoe box

All [electronic data storage](#) involves encoding data in binary format – a series of zeros and ones – and then recording it on a physical medium. DNA works in a similar way, but is composed of long strands of series of four nucleotides (A, T, C and G) that make up a "code." While the basic principle may be the same, the two methods differ greatly in terms of efficiency: if all the information currently on the internet was stored in the form of DNA, it would fit in a shoe box!

Recent advances in biotechnology now make it possible for humans to do what Mother Nature has always done. Today's scientists can create artificial DNA strands, "record" any kind of genetic code on them and

then analyze them using a sequencer to reconstruct the original data. What's more, DNA is extraordinarily stable, as evidenced by prehistoric fragments that have been preserved in amber. Artificial strands created by scientists and carefully encapsulated should likewise last for millennia.

To help demonstrate the feasibility of this new method, EPFL's Metamedia Center provided recordings of two famous songs played at the Montreux Jazz Festival: "Tutu" by Miles Davis, and "Smoke on the Water" by Deep Purple. Twist Bioscience and its research partners encoded the recordings, transformed them into DNA strands and then sequenced and decoded them and played them again – without any reduction in quality.

The amount of artificial DNA strands needed to record the two songs is invisible to the naked eye, and the amount needed to record all 50 years of the Festival's archives, which have been included in UNESCO's Memory of the World Register, would be equal in size to a grain of sand. "Our partnership with EPFL in digitizing our archives aims not only at their positive exploration, but also at their preservation for the next generations," says Thierry Amsallem, president of the Claude Nobs Foundation. "By taking part in this pioneering experiment which writes the songs into DNA strands, we can be certain that they will be saved on a medium that will never become obsolete!"

A new concept of time

At EPFL's first-ever ArtTech forum, attendees got to hear the two songs played after being stored in DNA, using a demonstrator developed at the EPFL+ECAL Lab. The system shows that being able to store data for thousands of years is a revolutionary breakthrough that can completely change our relationship with data, memory and time. "For us, it means looking into radically new ways of interacting with cultural heritage that

can potentially cut across civilizations," says Nicolas Henchoz, head of the EPFL+ECAL Lab.

Quincy Jones, a longstanding Festival supporter, is particularly enthusiastic about this technological breakthrough: "With advancements in nanotechnology, I believe we can expect to see people living prolonged lives, and with that, we can also expect to see more developments in the enhancement of how we live. For me, life is all about learning where you came from in order to get where you want to go, but in order to do so, you need access to history! And with the unreliability of how archives are often stored, I sometimes worry that our future generations will be left without such access... So, it absolutely makes my soul smile to know that EPFL, Twist Bioscience and their partners are coming together to preserve the beauty and history of the Montreux Jazz Festival for our future generations, on DNA! I've been a part of this festival for decades and it truly is a magnificent representation of what happens when different cultures unite for the sake of music. Absolute magic. And I'm proud to know that the memory of this special place will never be lost."

Provided by Ecole Polytechnique Federale de Lausanne

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