

Leonardo DNA Project

Strategy, goals and aspirations.

A bridge across science, history and art

While Leonardo di Ser Piero da Vinci is one of history's most famous characters, little is known about the ancestry or biology of this diversely gifted individual. Honoring Leonardo's fascination with science, an international team has embarked on a quest to obtain, sequence, and decode Leonardo's genome, in order to use this information to learn about his life and achievements.

History and aspirations

In 2014, distinguished physical anthropologists Professors Henry de Lumley (Paris) and Brunetto Chiarelli (Florence) decided together with Jesse Ausubel (New York) to carry out pioneering research using new tools in life sciences to explore certain aspects of Leonardo.

They assembled the team for the Leonardo DNA Project, including eminent specialists from a variety of academic disciplines based in different institutions in Europe and the United States.

The central goal is to use pioneering techniques to obtain biological materials with traces of DNA attributable to Leonardo – from his notebooks, descendants, burial places, artworks, and other sources. DNA sequences and other new data might offer fresh insights about the extraordinary visual acuity of Leonardo, his family history, and materials he used. Microbiomes living on the surface of his works might provide information on how to slow the degradation of cultural heritage.

Initial strategy

Leonardo was only illegitimate child of his father, Ser Piero, and mother, Caterina. While Leonardo had no children, team members have researched his ancestors and descendants of his relatives. His father sired a dozen or more children with other wives, and his mother also had more children with another man. The DNA of both deceased family members and living descendants might be able to help build the genome of Leonardo. Team members have traced a family tree spanning twenty generations family tree that provides a wealth of information about the familial context in which Leonardo grew up. Living male descendants of his half-brothers should possess the same Y-chromosome as Leonardo, if the paternity of the written records is true. In fact, many da Vinci family members are buried in the Badia Fiorentina monastery in the center of Florence. Through possible descendants of his mother, whose family is poorly documented, the team seeks to discover mitochondrial DNA.

Over 7,000 pages of Leonardo's notebooks survive. These could provide skin cells, saliva, or blood with DNA.

Team members also seek new sources of biological materials, such as finger prints and hairs, to confirm their provenance.

Tomb in Amboise, France

Leonardo's remains are believed to be buried in the beautiful Chapelle St-Hubert in the Chateau d'Amboise.

Genealogy from the Museo Ideale

Alessandro Vezzosi and Agnese Sabato have conducted exhaustive research to reconstruct Leonardo's genealogy. They have been able to re-construct 20 generations of the Da Vinci family and identify some living relatives of the artist, and consolidated an unbroken male line from Leonardo's half brothers to his living descendants born in 1945 and 1976.

Summary of potential sources of Leonardo's DNA

For every source, there are challenges of provenance and/or contamination.

- DNA from bones in tombs of his family members (father, half-brothers, and other close relatives).
- DNA from living descendants obtained from saliva, sweat, or blood.
- DNA lifted from Leonardo's notebooks or works of art, especially paper or metal point drawings.
- Other relics or materials associated with the life and work of Leonardo.
- DNA from bones, teeth, or hairs in his tomb in Amboise, France or preserved elsewhere as relics.

Museums, private collectors, and auction houses also hold objects that may have some association with Leonardo. Many of these associations are controversial. Could new biological evidence contribute to reliable association or even attribution? If the Leonardo DNA project can establish a reliable genetic signature, then perhaps some mysteries surrounding Leonardo could be solved.

How to reconstruct a genetic marker for Leonardo da Vinci: The Y chromosome-based method.

Unfortunately, the mitochondrial trace is lost because we have no information about the female descendants from Caterina and her burial place.

However, we can easily follow the Y chromosome route from generation to generation, starting from one of Leonardo's half-brothers (Domenico Matteo) and arriving up to today to his living male descendants who carry the same Y chromosome as Leonardo.

We have the possibility to analyze the Y chromosome of living descendants of Leonardo, as well as going back in time and studying bone remains of deceased relatives.

From them, we will reconstruct the Y chromosome profile of Leonardo, and we could compare this profile to the ones obtained from some alleged relics of the artist.

Final goal

Once we have obtained the Y chromosome genetic profile of Leonardo's living and deceased descendants, checked for their match and verified the Y lineage, we will know Leonardo's family Y chromosome.

This genetic marker could be used to authenticate relics of the genius and to open the way to the sequencing of Leonardo da Vinci's complete genome.

Characterizing microbial signatures on artwork

Oxidative bacteria and other microbes that live on the surface of works of art and even inside them may eat oils and other materials used by artists such as Leonardo.

Manolito Torralba, Karen Nelson, and their colleagues are characterizing microbial signatures on artwork to improve identification, preservation, and restoration of cultural heritage.

Why use DNA or other biological materials?

DNA sequencing will influence cultural heritage, dating and preservation. Now biology joins the venture.

Ongoing work spans refinement of genealogies, DNA extraction, human DNA analysis, inhibition experiments (e.g., to study damage to fresh DNA samples by various kinds and colors of paint), and microbial analysis.

In recent decades, the study of ancient DNA, aDNA, has revolutionized knowledge of the history of many species of plants and animals, including humans. We have learned, for example, about how early humans spread around the world, and also how languages and agriculture spread. The Leonardo DNA Project aims to catalyze the use of new biology to understand and preserve cultural heritage.

Genetics and Leonardo's face

What if we finally obtain a large segment of Leonardo's genome? It may then be possible to predict many of his traits, such as the appearance of his face, and medical conditions. An accurate identification of his bones could reveal his cause of death as well as his diet, which may have been vegetarian, among other things.

With 21st century science, the Leonardo da Vinci DNA Project aims to make discoveries about the ancestry, life and work of Leonardo, and about human biology. We hope that the project will also stimulate the development of new tools in genetics and microbiology in relation to art history and conservation. We trust that Leonardo would have endorsed this project fusing arts and sciences!

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Leonardo da Vinci

Los rostros del genio
The Faces of the Genius

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