Through DNA, breathing new life into old museum pieces

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In 1902, the National Zoo in Washington D.C. brought in a unique and endangered animal called the thylacine, or Tasmanian Tiger—a female and her three cubs.

But by the mid-1930s, the thylacine was extinct, leaving behind only preserved museum specimens.

Now, researchers are using DNA sequencing technology to analyze preserved thylacines, including one of those brought to the National Zoo. In the process they're making new discoveries in thylacine genomics and a burgeoning field called "museomics," the genetic study of museum specimens.

Broadly speaking, such research isn't limited to biology alone. A researcher from North Carolina State University is using DNA analysis to pinpoint the origin of medieval manuscripts, which were written on animal skin parchments.

The thylacine study is published in the Jan. 12 online edition of the journal Genome Research. The thylacine wasn't actually not a tiger, but a marsupial with many dog-like features—a striking example of "convergent evolution," scientists say, a process in which two unrelated creatures evolve similar characteristics.

Extensively hunted by farmers, the thylacine was becoming increasingly rare in the wild when the National Zoo acquired the female and cubs. Genetic sequences sampled from the preserved specimens of the National Zoo thyalcine family have been studied in recent years, but these investigations were limited by DNA contamination and degradation.

Now, researchers say they're using improved methods for sampling and sequencing, or decoding, DNA to analyze the samples.

In addition to refining the place of this unusual animal in evolutionary history, genetic clues to the impending extinction of the thylacine became apparent, said Anders Götherström of Uppsala University in Sweden, one of the authors of the study.

"What I find amazing is that the two specimens are so similar," said Götherström. "There is very little genetic variation between them." Götherströn said a lack of genetic diversity is indicative of a species dying out, as the animal indeed was.

The work has paved the way for more detailed genetic analysis of the thylacine, opened the door to more museomic studies using the treasure trove of museum specimens worldwide, and will raise dialogue about even bigger projects, the researchers said. The large amount of DNA obtained in the study "demonstrates the feasibility of a thylacine genome project," said Stephan Schuster of Penn State University, also an author of the report.. "It will also revive discussions on the possible resurrection of the animal."

The use of DNA as a tool to shed light on museum specimens can extend well beyond the study of organisms themselves.

Thousands of painstakingly handwritten books produced in medieval Europe still exist today, but scholars have long struggled with questions about when and where the majority of these works originated. Now a researcher from North Carolina State University is using modern advances in genetics to develop techniques that will shed light on the origins of these cultural artifacts.

Many medieval manuscripts were written on parchment made from animal skin. English professor Timothy Stinson of the university is working to perfect techniques for extracting and analyzing the DNA contained in these skins with the long-term goal of creating a genetic database that can be used to determine when and where a manuscript was written. Previous determinations of manuscript origins were largely “based on the handwriting and dialect of the scribes who created the manuscripts – techniques that have proven unreliable for a number of reasons,” Stinson said.

Stinson said genetic testing could resolve these issues by comparing the DNA in mysterious manuscripts to the DNA in manuscripts whose origins are already reliably determined. Each manuscript can provide a wealth of genetic data, Stinson explains, because a typical medieval parchment book includes the skins of more than 100 animals. Stinson is to present findings of his early research at the annual meeting of the Bibliographical Society of America in New York City on Jan. 23.

Image; The two surviving thylacine cubs brought to the National Zoo in 1902, photographed two to three years after their arrival. One of these animals, most likely the one in front, is a specimen sequenced for the new study. (Photo courtesy of the Smith sonian Archives)