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Tutankhamun Redux

In February 2010, a team of molecular biologists unveiled a new picture of the life and death of Egypt's most famous pharaoh – Tutankhamun. EURAC's **Albert Zink**, a member of the Cairo lab team, explains the revelations that have come from this innovative analysis of the Egyptian Royal Family.

Your recent article in Journal of American Medical Association stole the attention of media around the world. Is this the first DNA research ever done on the Egyptian Royal Family?
Zink: It was the first of its kind. There had already been some work done on Egyptian mummies, but it primarily concentrated on DNA pathology – dealing with diseases such as tuberculosis or malaria. This is the first genetic research ever done that has tackled the problem of the genetic relationships of Egyptian mummies, especially royal mummies. Previous tests on Egyptian Royal Family gave negative results, so some people even argued at the beginning of our study that we would never get verifiable results.

This scepticism may have had a solid basis. When Howard Carter discovered the mummy of Tutankhamun almost 90 years ago, little did he realize that even touching the bones can hamper further research.
Zink: The mummy has been touched many times since its discovery and this is the major problem when dealing with ancient DNA. To avoid taking a contaminated sample, you cannot take it from the outer surface of the mummy, you always have to go deep inside. We did the sampling with a little bone drill so we could take the samples from inside Tutankhamun's bone material. The drill left small holes in the mummy, but nobody will ever see them.

You are also working on DNA analysis of Ötzi, the mummy in Bolzano's archaeology museum. Was the experience gained with Ötzi helpful when dealing with Tutankhamun?
Zink: It was essentially different because Ötzi is a different kind of mummy – a frozen mummy. The technique used to extract the DNA was quite similar, however we had to adapt our methods to Egyptian mummies because we encountered a unique set of problems. The biggest one was the embalming substances that the ancient Egyptians used, for example the bitumen, various waxes and oils. They caused problems during the extraction process, as they had diffused into the bone and inhibited the chemical reactions we needed to analyze the DNA. We had to clean the samples and get rid of all these substances. It took us almost half a year, but before we removed them our results were so poor we even thought that maybe there wasn't any DNA at all. We later realized that this embalming material had helped to protect the DNA of the mummy. So, on the one hand the mummification process gave us some problems finding the DNA, and on the other it clearly enhanced the DNA preservation.

You determined the family tree of Tutankhamun. Are there any other clues that molecular biology can give archaeologists to help reconstruct this past life?
Zink: Diseases, for instance – this is an area of research that really gives us insight into the past life styles. The results are not only based on molecular biology but also on other investigations such as computer tomography. For example, we detected malaria in King Tut and other family members, so now we know that this disease was present at that time and that it also reached the royals. We also have evidence that tuberculosis was present in ancient Egypt, maybe not among the royal family, but it was quite frequent in ancient times. This shows us that these people endured similar diseases as today. We learned from radiological images that ancient Egyptians also suffered from atherosclerosis, a hardening of the arteries that had been thought to be a contemporary disease linked to a mod-

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ern sedentary lifestyle. It is quite obvious now that the Royal Family had a very comfortable lifestyle like ours. They had protein rich diet and really didn't move too much—except for some hunting, they didn't do any kind of physical exercise.

What about Tutankhamun—what was his life and death like?
Zink: What we know is that he died very young, at 19-years-old, and had been in very bad health since his birth. He had some genetic malformations and malaria. Perhaps he died due to a combination of all those problems. Even if some media reports that the cause of his death was malaria, we cannot say for sure that he died from one condition or another.

Do you see a future for investigations similar to yours?
Zink: The next step should be to extend these investigations. It would be interesting to see the distribution of some diseases, for example, the frequency of malaria in the whole population. Did simple folk suffer from atherosclerosis as well, what was their lifestyle, and did their nutrition patterns influence the diseases? Other research on ancient DNA could show us where the ancient Egyptians came from, whether they are an African or European population, or maybe a population coming from the Near East. Also, archaeology and molecular biology should be combined. We need archaeology to know what mummies we are dealing with: were they kings or common people? What is written on the temple walls isn't always the reality. The images in royal tombs show mostly the pharaohs in their glory, and depict their victories, whereas our investigation gives us clues about their real lives. So we kind of created a new picture.

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