

Oetzi's 'non-human' DNA

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Oetzi's human genome was decoded from a hip bone sample taken from the 5,300 year old mummy. However the tiny sample weighing no more than 0.1 g provides so much more information. A team of scientists from EURAC in Bolzano and the University of Vienna successfully analysed the non-human DNA in the sample. They found evidence for the presence of *Treponema denticola*, an opportunistic pathogen involved in the development of periodontal disease. The results have been published in *PLOS ONE*.

Much of what we know about Oetzi – for example what he looked like or that he suffered from lactose intolerance – stems from a tiny bone sample which allowed the decoding of his genetic make-up. Now, however, the team of scientists have examined more closely the part of the sample consisting of non-human DNA. "What is new is that we did not carry out a directed DNA analysis but rather investigated the whole spectrum of DNA to better understand which organisms are in this sample and what is their potential function", is how Frank Maixner, from the EURAC Institute for Mummies and the Iceman in Bozen/Bolzano, described the new approach which the team of scientists are now pursuing.

"This 'non-human' DNA mostly derives from [bacteria](#) normally living on and within our body. Only the interplay between certain bacteria or an imbalance within this bacterial community might cause certain diseases. Therefore it is highly important to reconstruct and understand the [bacterial community](#) composition by analysing this DNA mixture," said Thomas Rattei, Professor of Bioinformatics from the Department of

Microbiology and Ecosystem Science at the University of Vienna.

Unexpectedly the team of scientists, specialists in both microbiology as well as bioinformatics, detected in the DNA mixture a sizeable presence of a particular bacterium: *Treponema denticola*, an opportunistic pathogen involved in the development of periodontitis. Thus this finding supports the computer tomography based diagnosis that the Iceman suffered from periodontitis. Even more surprising is that the analysis of a tiny bone sample can still, after 5,300 years, provide us with the information that this opportunistic pathogen seems to have been distributed via the bloodstream from the mouth to the [hip bone](#). Furthermore, the investigations indicate that these members of the human commensal oral microflora were old bacteria which did not colonise the body after death.

Besides the opportunistic pathogen, the team of scientists led by Albert Zink – head of the EURAC Institute for Mummies and the Iceman – also detected *Clostridia*-like bacteria in the Iceman bone sample which are at present most presumably in a kind of dormant state. Under hermetically sealed, anaerobic conditions, however, these bacteria can re-grow and degrade tissue. This discovery may well play a significant part in the future conservation of the world-famous mummy. "This finding indicates that altered conditions for preserving the glacier mummy, for example when changing to a nitrogen-based atmosphere commonly used for objects of cultural value, will require additional micro-biological monitoring," explained the team of scientists who will now look closer at the microbiome of the Iceman.

More information: Frank Maixner, Anton Thomma, Giovanna Cipollini, Stefanie Widder, Thomas Rattei, Albert Zink: Metagenomic Analysis Reveals Presence of *Treponema denticola* in a Tissue Biopsy of the Iceman. 18 Jun 2014 *PLOS ONE*, [DOI: 10.1371/journal.pone.0099994](#)

Provided by University of Vienna

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