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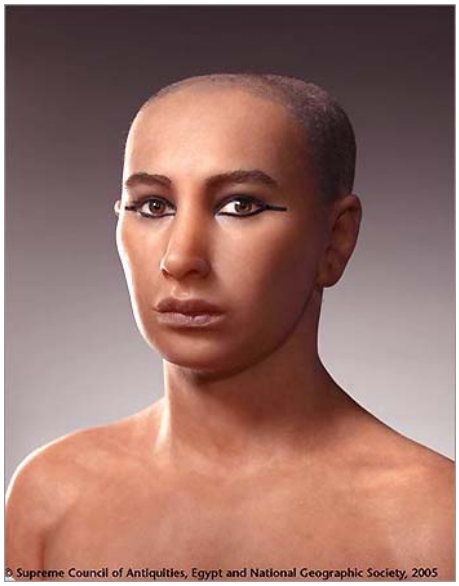
Malaria Is a Likely Killer in King Tut's Post-Mortem

People crowd around the golden mask of King Tutankhamun at the Egyptian museum in Cairo earlier this month.

King Tutankhamen, the boy pharaoh**, was frail** and lame and suffered "multiple disorders" when he died at age 19 about 1324 B.C., but scientists have now determined the most likely agents of death: a severe bout of malaria combined with a degenerative bone condition.



The mummified feet of King Tutankhamun in a 2007 photograph. Scientists have now determined that the boy pharaoh most likely died **of a severe bout of malaria** combined with a degenerative bone condition.

The researchers said that to their knowledge “this is the oldest genetic proof of malaria in precisely dated mummies.” Several other mummies in the study also showed DNA evidence of the presence of the malaria parasite Plasmodium falciparum, perhaps not surprising in a place like the Nile Valley.

The application of advanced radiological and genetic techniques to royal Egyptian mummies is a new step in the ever deepening reach of historical inquiry through science.

The study, reported Tuesday, turned up no evidence of foul play, as had been suspected by some historians and popular writers familiar with palace intrigues in ancient Egypt.

Previous examinations of the Tut mummy had revealed a leg fracture that happened sometime before his death, possibly from a fall. This might have contributed to a life-threatening condition in an immune system already weakened by malaria and other disorders, the researchers said.

In addition, genetic “fingerprinting” of the 11 mummies in the study established family connections over five generations of Tut’s lineage. The identities were previously certain for only three of the mummies. Now, scientists said, the tests have identified the mummies of King Tut’s father and mother, who appear to be siblings, as well as the mummies of his grandmother and other probable relatives.

The two-year investigation, completed in October, is described in the current issue of The Journal of the American Medical Association. The research was directed by Zahi Hawass, an Egyptologist who leads the Supreme Council of Antiquities in Cairo, and it involved medical scientists and anthropologists from Egypt, Germany and Italy. Carsten M. Pusch of the Institute of Human Genetics at the University of Tübingen, in Germany, was the report’s corresponding author.

In an accompanying editorial in the journal, Dr. Howard Markel, director of the Center for the History of Medicine at the University of Michigan, who was not involved in the study, praised the thoroughness of the new research "based on unfettered access to the actual mummies."

Recalling the myriad post-mortem claims that have surrounded the young king, Dr. Markel suggested that now "the legion of Tutankhamen admirers might be well advised to reconsider several existing theories."

A two-part program, "King Tut Unwrapped," will be shown on the Discovery Channel on Sunday and Monday. Dr. Hawass and others will discuss the new findings.

Though not one of the great rulers of ancient Egypt, King Tut is easily the best known in public lore. He was the son and successor of Akhenaten, the controversial reform pharaoh who ruled from about 1351 to 1334 B.C. Another achievement of the study was the first positive identification of Akhenaten's mummy, a historical puzzle in its own right.

The 1922 discovery of King **Tut's opulent tomb in** the Valley of the Kings, by the British archaeologist Howard Carter, was a sensation. The young king's visage and premature death in the ninth year of his reign inspired fanciful speculation, and the golden and bejeweled artifacts from his tomb still dazzle crowds at touring museum exhibitions.

One overall impression from the new research is that the royal family's power and wealth did not spare them from ill health and physical impairment. Several mummies revealed instances of cleft palate, clubfeet, flat feet and bone degeneration. Four of the 11 mummies, including King Tut's, had genetic traces of malaria tropica, the most severe form of the infection.

The mummified feet of King Tutankhamun in a 2007 photograph. Scientists have now determined that the boy pharaoh most likely died of a severe bout of malaria combined with a degenerative bone condition.

The researchers said several other pathologies were diagnosed in the Tut mummy, including a bone disorder known as Köhler's disease II, which alone would not have caused death.

But he was also afflicted with avascular bone necrosis, a condition in which diminished blood supply to the bone leads to serious weakening or destruction of tissue. The finding led to the team's conclusion that it and malaria were the most probable causes of death.

The effects of this bone disease, notably the "definitely altered structure" of the left foot, probably explained the presence of walking canes in the Tut tomb, the researchers said.

Speculation had also centered on the fact that Tutankhamen left no heirs and on the stylized reliefs and other sculptures showing him and others in his family with a somewhat feminized or androgynous appearance. This suggested certain inherited syndromes, including gynecomastia, which is the excessive development of breasts in men, usually the result of a hormonal imbalance.

The breasts of Akhenaten and Tutankhamen were not preserved. But Tut's penis, no longer attached to the body, "is well developed," the researchers reported.

"Most of the disease diagnoses," the scientists concluded, referring to the earlier theories, "are hypotheses derived by observing and interpreting artifacts and not by evaluating the mummified remains of royal individuals apart from these artifacts."

Dr. Markel, the medical historian, commented that use of 21st-century radiological and genetic techniques in studies of human history raised ethical questions that needed to be addressed.

Writing in the journal, he asked**z** Are major historical figures entitled to the same privacy rules that private citizens enjoy even after death? Most pragmatically, what is actually gained from such studies? Will they change current thinking about and prevent threatening diseases such as influenza? Will they change the understanding of the past, such as the Jefferson study's powerful elucidation of intimacy during the era of slavery and the Tutankhamen study's window on the conduct of the royal family of Egypt?"