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# Microbiological Analysis of a Mummy from the Archeological Museum in Zagreb

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## ABSTRACT

*In this paper we report the results of the microbiological analysis of the samples taken from the mummy from the collection of the Archaeological museum in Zagreb, Croatia. Samples were taken from specific places such as oral, orbital, abdominal cavity and bandages surrounding the mummy, and analyzed in Department of Microbiology and Hospital Infections in University Hospital »Dubrava« in Zagreb and in National Reference Laboratory for systemic mycoses of Croatian National Institute of Public Health in Zagreb. The analysis indicated that all of the found organisms were non-primary pathogenic and are not harmful for healthy humans. Isolated microorganisms mainly belonged to the group of saprophytic fungi as listed: Monilia spp., Penicillium spp., Alternaria spp., Aspergillus fumigatus, Aspergillus nidulans, Rhizopus spp. and Chrysosporium spp. and to the genus of saprophytic bacteria, Bacillus spp.*

**Key words:** microbiology, mummies, paleopathology, paleoradiology, ancient Egypt

## Introduction

In 2008 a sarcophagus containing what was presumed to be human mummified remains was given for the analysis to the Institute for anthropological research in Zagreb. Results of the analysis and dating of the remains are reported in this volume<sup>1</sup>. In order to proceed with the analyses it was necessary to provide the results of the microbiological analysis in order to make sure the remains present no danger to the investigators and patients of the Hospital where the CT scanning was later performed.

## Materials and Methods

We have taken the samples from the mummified body (Table 1); oral (Figure 1), orbital and abdominal cavity (Figure 2) and bandages that were wrapped around the

mummy. Microbiological study was done at the Department for Microbiology and Hospital Infections in Dubrava University Hospital and in the National Reference Laboratory for Systemic Mycoses of Croatian National Institute of Public Health. The samples from the mummy were inoculated on the following nutrient media: Blood agar bases supplemented with 5–10% sheep blood; MacConkey agar; Brain Heart Infusion Agar with vitamin K and hemin for the enrichment of anaerobes and Sabouraud agar with chloramphenicol. The media for bacterial cultivation were incubated at 35°C in aerobic and anaerobic atmosphere through 7 days. Isolation and identification of bacteria was carried out according to the routine microbiological protocol<sup>2</sup>. The media for fungal isolation were incubated at 27°C and 37°C in aerobic condition during 14 days. Identification of fungal isolates



Fig. 1. Sample taken from oral cavity.

was conducted according to their macro and micro morphologic characteristics<sup>3</sup>.

## Results

The microorganisms we found mainly belong to the genera of saprophytic moulds as listed: *Monilia* spp., *Penicillium* spp., *Alternaria* spp., *Aspergillus fumigatus*, *Aspergillus nidulans*, *Rhizopus* spp., *Chrysosporium* spp. and to the genus of saprophytic bacteria, *Bacillus* spp.

Therefore, the results of the microbiological analysis clearly show that the microorganisms isolated from the mummy pose no threat to human health because they can all be found in normal air flora, and are ubiquitous in nature, rarely associated with disease<sup>4,5</sup>.



Fig. 2. Sample taken from the abdominal cavity.

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**TABLE 1**  
LIST OF SAMPLES TAKEN AND MICROORGANISMS FOUND

Places from which the samples were collected	Microorganisms found
Swab of the white deposit on the head	<i>Bacillus</i> spp. <i>Monilia</i> spp. <i>Penicillium</i> spp.
Swab of the oral cavity	<i>Bacillus</i> spp. <i>Penicillium</i> spp. <i>Monilia</i> spp.
Swab of the orbital cavity	<i>Bacillus</i> spp.
Swab of the opening on the thorax (abdominal, upper, superficial)	<i>Bacillus</i> spp. <i>Penicillium</i> spp. <i>Alternaria</i> spp. <i>Aspergillus fumigatus</i>
Swab of the abdominal cavity	<i>Bacillus</i> spp.
Swab of the white stripe on the bandage (level of the knee)	<i>Bacillus</i> spp. <i>Aspergillus fumigatus</i> <i>Aspergillus nidulans</i>
Swab of the white pappule (level of the lower leg)	<i>Bacillus</i> spp. <i>Aspergillus fumigatus</i> <i>Rhizopus</i> spp.
Swab of the foot	Sterile
Swab of the cranial bandage (frontal white deposit)	<i>Bacillus</i> spp.
Swab of the thoracic bandage	<i>Bacillus</i> spp. <i>Chrysosporium</i> spp. <i>Penicillium</i> spp.
Swab of the thoracoabdominal opening (white deposit)	<i>Bacillus</i> spp. <i>Chrysosporium</i> spp. <i>Monilia</i> spp.

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## MIKROBIOLOŠKA ANALIZA MUMIJE IZ ARHEOLOŠKOG MUZEJA U ZAGREBU

### SAŽETAK

U radu su izneseni rezultati mikrobiološke analize uzoraka uzetih s mumije u vlasništvu Arheološkog muzeja u Zagrebu. Uzorci iz oralne, orbitalne, abdominalne šupljine, te zavoja mumije analizirani su u Odjelu za kliničku mikrobiologiju i bolničke infekcije KB »Dubrava« u Zagrebu te Nacionalnom referentnom laboratoriju za sistemske mikoze Hrvatskog nacionalnog instituta za javno zdravstvo u Zagrebu. Rezultati analize su pokazali da organizmi ne predstavljaju opasnost po ljudsko zdravlje i većinom pripadaju gljivicama: *Monilia spp.*, *Penicillium spp.*, *Alternaria spp.*, *Aspergillus fumigatus*, *Aspergillus nidulans*, *Rhizopus spp.* i *Chrysosporium spp.*, te bakteriji iz roda *Bacillus spp.*