

Ancient permafrost staphylococci carry antibiotic resistance genes.

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Abstract

Background: Permafrost preserves a variety of viable ancient microorganisms. Some of them can be cultivated after being kept at subzero temperatures for thousands or even millions of years.

Objective: To cultivate bacterial strains from permafrost.

Design: We isolated and cultivated two bacterial strains from permafrost that was obtained at Mammoth Mountain in Siberia and attributed to the Middle Miocene.

Bacterial genomic DNA was sequenced with 40660 "eqxgtc ig"cpf" jki j/swcnkv{" contigs were assembled. The first strain was assigned to *Staphylococcus warneri* species (designated MMP1) and the second one to *Staphylococcus hominis* species (designated MMP2), based on the classification of 16S ribosomal RNA genes and genomic sequences.

Results: Genomic sequence analysis revealed the close relation of the isolated ancient bacteria to the modern bacteria of this species. Moreover, several genes associated with resistance to different groups of antibiotics were found in the *S. hominis* MMP2 genome.

Conclusions: These findings supports a hypothesis that antibiotic resistance has an ancient origin. The enrichment of cultivated bacterial communities with ancient permafrost strains is essential for the analysis of bacterial evolution and antibiotic resistance.

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