

# Black death strains persisted to create repeated European outbreaks

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A photo from a 1994 excavation of the plague mass grave of l'Observance – Marseille. Credit: Olivier Dutour

An international team of researchers has uncovered new information about the Black Death in Europe and its descendants, suggesting it persisted on the continent over four centuries, re-emerging to kill hundreds of thousands in Europe in separate, devastating waves.

The findings address the longstanding debate among scientists about whether or not the bacterium *Yersinia pestis* –responsible for the Black Death—remained within Europe for hundreds of years and was the principal cause of some of the worst re-emergences and subsequent [plague](#) epidemics in human history.

Until now, some researchers believed repeated outbreaks were the result of the bacterium being re-introduced through major trade with China, a widely-known reservoir of the plague. Instead, it turns out the plague may never have left.

"The more plague genomes we have from these disparate time periods, the better we are able to reconstruct the evolutionary history of this pathogen" says evolutionary geneticist Hendrik Poinar, director of McMaster University's Ancient DNA Centre and a principal investigator at the Michael G. DeGroote Institute for Infectious Disease Research.

Poinar collaborated with Edward Holmes at the University of Sydney, Olivier Dutour of the École Pratique des Hautes Études in France, and Kirsti Bos and Johannes Krause at the University of Tübingen, and others, to map the complete genomes of *Y.pestis* which was harvested from five adult male victims of the 1722 Plague of Provence.

To do so, they analyzed the dental pulp taken from the five bodies, originally buried in Marseille, France. Researchers were able to extract, purify and enrich specifically for the pathogen's DNA, and then compare

the samples with over 150 plague genomes representing a world wide distribution as well as from other points in time, both modern and ancient.

By comparing and contrasting the samples, researchers determined the Marseille strain is a direct descendant of the Black Death that devastated Europe nearly 400 years earlier and not a divergent strain that came, like the previous pandemic strains Justinian and Black Death, from separate emergences originating in Asia.

More extensive sampling of modern rodent populations, in addition to ancient human and rodent remains from various regions in Asia, the Caucasus and Europe, may yield additional clues about past ecological niches for plague.

"There are many unresolved questions that need to be answered: why did the plague erupt in these devastating waves and then lay dormant? Did it linger in the soil or did it re-emerge in rats? And ultimately why did it suddenly disappear and never come back? Sadly, we don't have the answer to this yet," says Poinar.

"Understanding the evolution of the plague will be critically important as antibiotic resistance becomes a greater threat, particularly since we treat modern-day plague with standard antibiotics. Without methods of treatment, easily treatable infections can become devastating again," he says.

The research was published online today in the bioarchive *bioRxiv*, and is under review at the journal *eLife*.

Provided by McMaster University

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